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ABSTRACT

The current status and frequency of nonmajor biology courses offered in colleges and universities in the United States and Canada were investigated. A random sample of 300 four-year colleges was sent a questionnaire and a request for copies of their syllabi for nonmajor biology courses and other nonmajor science courses. Of the 134 respondents, 100 had at least 1 nonmajor biology course, and syllabi were sent for 62 of the 100 courses. The information about availability, type, format, goals and emphases, and content of nonmajor biology courses was to be used by educators interested in science for the nonscience major, and by faculty at Saint Mary's College, Indiana, to aid in a revision of a two-semester nonmajor biology course. The total number of titles for nonmajor biology courses was 186 with 31 percent of these general biology titles. The rest were mostly topics courses divided into 11 areas. The nonmajor biology courses were 60 percent general courses. Most of the 100 nonmajor biology courses could be used to help meet science core requirements, while the majority also lacked prerequisites. The three most popular course goals were to understand biological principles and concepts, to understand human biology, and to understand the interactions of the biosphere and the human role in it. Analysis of the 62 syllabi was limited to lecture examinations, lecture content, and laboratory content. The typical nonmajor biology course had no prerequisites and was a one semester, 3- or 4-hour course. The format was lecture three times per week and a traditional laboratory. A literature review and study recommendations are included, along with a sample questionnaire and syllabus content form. (SW)

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A COMPREHENSIVE ANALYSIS OF NONMAJOR BIOLOGY COURSES IN COLLEGES AND UNIVERSITIES

BY

JANICE M. IVKOVICH

U.S. DEPARTMENT OF EDUCATION
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Study Directed
by
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CHAPTER I

INTRODUCTION

Science courses for the nonscience major in four-year colleges and universities have been the topic of considerable debate. Science educators have been increasingly concerned about achieving a society that is knowledgeable in the basic concepts, methods, problems, and issues of modern science. To achieve this in the area of biology, nonscience majors have been mainly offered general or topics nonmajor biology courses, or general courses including both majors and nonmajors. As stated in Science for Non-Specialists: The College Years, college science educators focused on the science major, but left the nonscientist unattended. (xv) For the educator, now interested in developing an improved nonmajor biology course for the nonscience major, inadequate information has existed about the present status of these courses.

The Problem

This study was conducted to determine the current status and frequency of nonmajor biology courses offered in colleges and universities in the United States and Canada. Specifically, answers were sought for the following questions:

A. Extent of nonmajor biology courses:

1. How many institutions offer nonmajor biology courses?
2. What types of nonmajor biology courses are offered?
3. If no nonmajor biology courses are offered, are there biology courses for both majors and nonmajors or other nonmajor science courses?

B. For a specific (most general) nonmajor biology course per institution:

1. Does the course satisfy a science core requirement?
2. What are the prerequisites, length, enrollment, and organization of the course?
3. What are the goals and emphases of the course and does it meet the desired goals of science educators?
4. What materials, including audiovisuals, are used in the course?
5. Are there provisions for the exceptional student, and if so, what are they?
6. What are the lecture evaluation requirements, lecture content, and laboratory content of the course?
7. Will there be a major revision of the course before 1983?

C. Are there presently any general nonmajor biology courses that could serve as a model for development of a course that meets the desired goals of science educators?

Purpose

This study was intended to provide a valuable resource for any institution considering development of a new nonmajor biology course or revising an old one. Also, it was meant for comparative use with existing courses. The results were expected to aid in the revision of Biology and Human Values, a general nonmajor biology course at Saint Mary's College, Notre Dame, Indiana. The data, as well as all syllabi received, were collected for examination for specific suggestions and methods of instruction that would improve the course.

Organization and Procedure

The data concerning nonmajor biology courses was collected from a random sample of 300 four-year colleges and universities in the United States and Canada. A questionnaire was sent to each of the institutions selected, along with a request for copies of their syllabi for nonmajor biology courses and other nonmajor science courses.

Sample. The population for this study was the colleges and universities offering a bachelor's degree in biology as listed in Peterson's Annual Guide to Undergraduate Study 1981. (55-58) All institutions offering only associate degrees, as well as Saint Mary's College, were removed from the list leaving a total of 1,200 institutions as the population of the study.

A systematic sample was obtained by randomly selecting one institution out of every four on the list. (Sax: 190) A table of 300 random numbers, 1-4, was prepared by rolling a die using the following method:

Roll a die -
A. If die is 1-3 go to . . . . B
A. If die is 4-6 go to C
Roll a die -
B. If die is 1-3 select. 1
B. If die is 4-6 select. 2
Roll a die -
C. If die is 1-3 select. 3
C. If die is 4-6 select. . . . . 4.

Information about institutional control, student body composition, undergraduate enrollment, degrees awarded, and presence or absence of core requirements for each of the 300 institutions in the sample was obtained from Peterson's Annual Guide to Undergraduate Study, 1982. The 1982 edition became available after the sample was prepared. All of the institutions in the sample were accredited.

Questionnaire. A questionnaire with both closed and open form questions, was prepared since it would be the least expensive and simplest method to acquire the desired data. (VanDalen: 301-302) The questionnaire was developed according to suggestions in Jones (142-143), Good and Scates

(614-622), and Best (161-172). It was mailed to each institution in the sample on February 10, 1982 along with a cover letter, a postage paid return envelope for answered questionnaire, an address label for syllabi (requested separate return), and a blank address label if a copy of the summary was desired. On March 10, 1982 a follow-up post card was sent to speed up returns. (Best: 172) April 23, 1982 was the cut off date for accepting returns. Samples of the cover letter, questionnaire, and post card are found in Appendix A.

The questionnaire and cover letter requested copies of nonmajor science course syllabi be mailed separately from the questionnaire, as prepaid postage funds were not available. The syllabi received were analyzed by a specially prepared form, Syllabus Content Form, found in Appendix A. Syllabi were requested in order to keep the questionnaire at a manageable length to maximize returns, and still be able to acquire additional information about the course's content.

Limitations of the Study

The use of a questionnaire has inherent limitations as described by Sax (245-246) and VanDalen (301). The motivation of the respondents and accuracy of responses were unknown, although some responses were verified from the syllabi. Of the respondents, 13 percent planned revision of their course; and some of them indicated interest in the study results for this reason.

Reasons for nonresponse could have been any or a combination of the following:

1. Loss in mail. (Four institutions indicated this by letter or telephone after receiving the follow-up post card.)
2. Questionnaires were sent to the Biology Department Chairmen requesting they be given to the professors responsible for the nonmajor biology courses. Consequently, there was the possibility of loss in transfer.
3. Lack of interest or time. No syllabi available.
4. Perceived their nonmajor biology course as inadequate.
5. Dislike of questionnaires or this particular questionnaire.

Other limitations to the study were variations within the syllabi themselves, some being more complete than others. This reduced the usefulness of syllabi for generalizations to include in the study. Information relating to course goals and content sometimes required a judgment to place it into a category. There appeared to be confounding data for the second part of question five and question six b. Nevertheless, use of a questionnaire was considered a valid method to obtain the desired data.

Definition of Terms

The terms used in this study with specific meanings are defined as follows:

Audiotutorial method. A self pacing multimedia system of instruction that features tape recorded lessons with kits of learning materials and instruction sheets for individual learning in study carrels. (Good: 50)

Bioethics. To consider the ethical implications of biology as students consider the principles of biology. (Creager: 496)

Biosocial. Possessed of characteristics that stem both from biological and from social forces or processes. (Good: 63)

Closed form question. A question that calls for short check responses. (Best: 162)

Concept. Any general or abstract intellectual representation of a situation, state of affairs, or object. (Good: 124)

Core requirement. A structure of required courses that students must complete before they begin to major. (Reeves: 583)

Critical thinking. The ability to grasp information, examine it, evaluate it for soundness, and apply it appropriately. (Science for Non-Specialists: The College Years: 16)

Exceptional student. Description of a pupil who displays a deviation from the normal by a considerable amount in respect to any one of a number of traits. (Good: 223)

General Biology Course. Course that reviews the major concepts and general content of biology (survey course). (Hayes: 85-86)

Nonmajor. A person enrolled for course work in a given field but not following the prescribed curriculum leading to a degree or certificate in that field. (Good: 387)

Open form question. A question that allows free response in the respondent's own words. (Best: 163)

Questionnaire. A list of planned, written questions related to a particular topic, with space provided for indicating the response to each question, intended for submission to a number of persons for reply, commonly used in normative survey studies and in the measurement of attitudes and opinions. (Good: 464-5)

Respondent. Any recipient of a questionnaire who actually replies to the questionnaire. (Good: 496)

Science, applied biological. Organized knowledge at an application level about living things. (Good: 571)

Scientific literacy. An understanding of the basic concepts in science, nature of science, ethics that control the scientist in his work, interrelationships of science and the humanities and differences between science and technology. (Pella, O'Hearn, and Gale: 206)

Scientific method. Procedures or operations used to acquire and systematize knowledge concerning things and phenomena experienced in observation and experiment, or to test hypotheses (propositions) or assertions about the empirical world. In special areas of research, it includes the use of instruments applicable in a particular area for controlled observations and experimentation, the use of techniques, particularly mathematical, to give precise description of things observed, and the description of possible or probable relations as a means to further discovery. (Good: 518)

Syllabus. A condensed outline or statement of the main points of a course of study. (Good: 578)

Topics Biology course. The emphasis is on a single topic, usually of societal concern. (Hayes: 85-86)

CHAPTER II

REVIEW OF RELATED LITERATURE

A review of related literature revealed three areas which applied to this study:

1. Examples of innovative nonmajor biology courses which were compared with data from this study.
2. Articles emphasizing the primary goal of science education for the nonscientist should be a scientifically literate society. This goal was a criterion to compare with the goals of the respondents' courses.
3. Surveys which included nonmajor biology courses.

Innovative Courses

The literature included examples of nonmajor biology courses developed to aid the nonscience student in attaining scientific literacy. To actualize that goal Barman organized a nine unit, self paced course based on personalized instruction, audiotutorial presentations, simulations, laboratory activities, and films. (184-188, 195) Lynch's nonmajor biology course had a similar goal but used lecture, discussion sections, special seminars, and audiotutorial laboratory. (75-76) Durger's introductory, audiotutorial, two semester biology course enrolled 800 to 900 students per semester. It presented the basic concepts of biology to enable students to deal intelligently with current biological issues. Examples of the innovative and humanistic methods used were audiotapes, discussion sections requiring written and oral reports, newsletters, social activities (bio-picnic), film nights, biophone service, and conference days. These were designed to bring about student involvement in biology. (164-167) Reeves presented an interdisciplinary science course for nonscience majors but stated such courses would never satisfy the need for laboratory work in a specific introduction to the nature of science. He advocated specifying a laboratory course as part of the science core requirements. (584) The above courses used student evaluations as a course success and goal achieving indicator. Evidence that the courses produced scientifically literate students was lacking, but the goals, content, and methods used showed an attempt being made.

Scientific Literacy

A majority of the literature reviewed pertained to scientific literacy. Science educators felt that the basic science courses for the nonscientist in high schools and colleges should produce the scientifically literate citizens needed to participate in democracy and to solve present and future biosocial problems.

A report, Science and Engineering Education for the 1980's and Beyond, stated that provisions for the science education of college students who intended to enter non-scientific careers were inadequate. The courses offered were less rigorous and more descriptive than those for science students. Although interdisciplinary courses in science, technology, and society were viewed as important, they should not be considered a substitute for courses dealing with the concepts and processes of science and technology. (39-40)

Brovey delcared that our present society is scientifically aware but scientifically illiterate. To remedy this he advocated teaching how to use and interpret scientific information from elementary school through college. (88-91)

Roy recommended the following improvements in nonmajor science education:

1. The present science courses must include new fields, especially in applied sciences.
2. The material presented should work back from applied science to basic concepts.
3. Science, technology, and society concepts must be incorporated in required science courses.

He, too, felt scientists had ignored the science education of the nonscientist. (84,94)

Yager reviewed definitions of scientific literacy and indicated that 90 percent of the American population was scientifically illiterate. He argued that basic courses in high schools and colleges focused on content and testing of concepts, rather than the nature of science, its functions, ethics, issues, and relationship with society. (154-156)

Dean listed 10 components of a nonmajor biology course. He stressed that nonmajors were more diverse and less motivated but just as capable as majors. Nonmajors deserved courses by the best teachers that were unique, well planned, human and socially oriented, based on biological concepts and problem solving. A nonmajor biology course should never be an introduction to biology courses the nonmajor will never take. (564-565)

Surveys of Nonmajor Biology Courses

There is no literature pertaining solely to surveys of nonmajor biology courses; however, a few surveys of related fields included nonmajor biology courses. In 1972 Kormondy, Kastrinos, and Sanders surveyed the first-year biology courses of 100 colleges and universities. Of the 68 responses, 54 had more than one introductory course and 14 had only one for both majors and nonmajors. The 54 institutions offered a total of 236 courses of which 132, or 56 percent, were strictly for nonmajors, and 72, or 30 percent, were for both majors and nonmajors. More than half of the nonmajor courses were topics or issue oriented courses. Most of the survey applied to biology courses for majors. (217)

In 1977, Kastrinos and Terziotti completed a follow-up survey of first-year biology courses in 170 colleges and universities. Of the 67 respondents, 25 were the same as the 1972 study. Both surveys of the 25 were compared without distinguishing between major and nonmajor courses. The number of courses offered at the first-year level had decreased, and course content emphasis had changed. Cellular biology had decreased while organismal and population biology had increased. (44-45)

An unpublished survey of 12 universities by Wright showed nine with a core requirement for laboratory science. The total number of nonmajor biology courses offered was 46, of which 29 required a laboratory component. (Appendix S)

A recent report, Science for Non-Specialists: The College Years, explained the existing status of nonmajor science courses and made recommendations for improvements. Non-specialists were defined as individuals who do not major in the biological or physical sciences, mathematics, engineering, or the health sciences (nonscientists in this study). (xii) Part of the study was a survey of a stratified random sample of 215 four-year colleges and universities to determine science core requirements and courses available to nonscientists. The data source was the institution's catalogs for academic year 1979-1980. (89-95)

The major results of the study were:

1. College science education had benefited the science major while neglecting the nonscientist.

2. While 90 percent of the institutions had core requirements, the science core requirements have been gradually lowered to approximately seven percent of the college course load (about nine credit hours).
3. The choice of science courses for fulfilling the requirement included increasing numbers of topics courses that outgrew their relevancy and failed to provide an understanding of the basic principles of science.
4. The science courses for nonscience majors are often poorly taught using dull lectures without audio-visuals, demonstrations, and laboratory experiences. (xvi, 34-52)

The report's desired goals for science education for the nonscientist were similar to the general goal of scientific literacy for all citizens. Two other goals were the development of nonscientists' capacity to engage in critical thinking, and scientific and technical knowledge needed in their professions. (xvii) The report recommended raising science core requirements to no less than two one-year courses selected from the biological and physical sciences and mathematics. It deplored the trend eliminating the laboratory from the basic nonmajor science courses. (56-63) Other findings were the increased variety of nonmajor science courses over the past 20 years, more that half the nonmajor biology courses were topics courses; and general nonmajor biology course enrollments out-numbered those in physics and chemistry by 10 students to one. (38-52)

Summary

The literature on nonmajor biology courses discussed the following three areas:

1. Descriptions of innovative courses with a goal of scientific literacy. These were often audiotutorial.
2. Complaints about the present state of the courses followed by requests for the development and implementation of new courses having a goal of scientific literacy for students.
3. Surveys which described the availability and types of courses and/or science core requirements.

None of the literature presented an in depth analysis of nonmajor biology courses.

CHAPTER III

FINDINGS OF THE STUDY

The analysis of the data from the study was divided into five groups as follows:

1. Analysis of responding institutions using data from _Peterson's Annual Guide to Undergraduate Study, 1982_.
2. Analysis of nonmajor biology course respondents using data from questionnaires.
3. Analysis of nonmajor biology course respondents that sent syllabi using data from Syllabus Content Forms.
4. Analysis of respondents without nonmajor biology courses using data from questionnnaires.
5. Analysis of comments using data from open form questions on the questionnaires.

A total of 300 questionnaires was mailed to the Biology Department Chairmen at randomly selected colleges and universities. The number of institutions that responded was 136 of which two were not usable. This resulted in a usable response ratio of 45 percent as presented in Table 1. From this response generalizations were drawn concerning the present status of nonmajor biology courses at colleges and universities in the United States and Canada.

TABLE 1. ANALYSIS OF MAIL RETURNS

Mailed	Received	Not Usable	Total Usable*	Percent Respondents
300	136	2	134	45

* 3 out of 7 Canadian institutions responded (43%)

Analysis of Respondents

The responding institutions were characterized by type of institutional control, enrollment, student body composition, type of degrees awarded, and core requirements. This resulted in a description of the institutions included in the study.

Type of Institutional Control. A majority, 63 percent, of the respondents were independently controlled. These were grouped as Independent: Private, Independent: Religious (except Roman Catholic), and Independent: Roman Catholic. There were 37 percent publicly controlled institutions responding. When compared to the original sample, each of the four groups approximated or met the 45 percent usable response ratio. The complete data are presented in Appendix B, Tables 29 and 30.

Undergraduate Enrollment. A majority of the respondents were grouped in two areas of enrollment. Student enrollment between 501-1,500 described 53, or 40 percent of the respondents, while between 2,001-6,000 described 40, or

30 percent of the respondents. Respondents were received from each enrollment group as given in Appendix B, Table 31. Not shown are actual enrollment figures which ranged from 464 to 41,754 students. Therefore, the study contained respondents with a wide range of enrollment sizes.

Student Body Composition. The overwhelming majority, 96 percent, of the institutions responding was coeducational, while the remainder was either female or primarily female (greater than 80 percent). This data is found in Appendix B, Table 32. The following types of control of the institutions for women not shown in Table 32 were: one Independent: Private, one Independent: Religious, and four Independent: Roman Catholic.

Type of Degrees Awarded and Core Requirements. The majority, 64 percent, of the respondents granted master's or higher degrees. Core requirements were present in 95 percent of respondents. The data are presented in Appendix B, Tables 33 and 34.

Saint Mary's College's description was indicated on each of the above tables. Respondents' descriptions were included for comparison purposes for use of the study's results by Saint Mary's College and other institutions.

Analysis of Respondents with Nonmajor Biology Courses from Questionnaire

The questionnaire divided respondents into two groups described below:

1. Those offering nonmajor biology course(s). (There were 100, or 75 percent, in this group.)
2. Those that did not offer nonmajor biology courses. (There were 34, or 25 percent, in this group.)

This data is shown in Table 2.

TABLE 2. NUMBER AND PERCENTAGE OF RESPONDENTS OFFERING NONMAJOR BIOLOGY COURSE(S)

Nonmajor Biology Courses Offered?	f	%
Yes	100	75
No	34	25
Total	34	100

Each Group answered different questions on the questionnaire. All but two of the questions referred to the group with nonmajor biology courses. If more than one nonmajor biology course was offered, the respondents were instructed to use the most general course when answering the questionnaire, and to forward a copy of the course syllabus(i). Those sending syllabi represented 62 percent of the respondents with nonmajor courses as shown in Table 3.

TABLE 3. SYLLABUS (i) SENT BY RESPONDENTS FOR QUESTIONNAIRE'S NONMAJOR BIOLOGY COURSE

Syllabus (i) sent?	f	%
Yes	62	62
No	38	38
Total	100	100

The type of institution most likely to offer nonmajor biology courses was the Independent: Private group, 82 percent, while the least likely was the Independent: Religious group with 66 percent. This data is given in Appendix C, Table 35.

Titles of Nonmajor Biology Courses. Each of the 100 respondents with nonmajor biology courses was requested to list the titles of their courses and indicate the one upon which the questionnaire answers were based. The 189 titles were grouped in broad areas and are presented in Appendix D, Table 36. Those having a general course name (eg. Introduction to Biology) represented 31 percent of the courses. The specific titles in each grouping are listed in Appendix D (p. 93). Lastly, the titles of the 100 nonmajor biology courses used to answer the questionnaire are listed in Appendix D (p. 96). These were divided into general biology courses, 60 percent, and topics courses, 38 percent. A majority of the syllabi data was from general courses. The results are presented in Table 4.

TABLE 4. TYPE OF NONMAJOR BIOLOGY COURSE FOR ANALYSIS FROM QUESTIONNAIRES AND SYLLABI*

Type	Determination from Questionnaires, N=100		Determination from Syllabi, N=62	
	f	%	f	%
General Course	60	60	39	63
Topics Course	38	38	23	37
Not Known	2	2	--	--
Total	100	100	62	100

* See Appendix D, p. 96 for list of titles of the 100 nonmajor biology courses.

Requirements and Organization of Nonmajor Biology Courses. The largest portion of these courses, 94 percent, met or partially met the science core requirements of their institution. Data are presented in Table 5.

TABLE 5. NUMBER OF NONMAJOR BIOLOGY COURSES THAT MEET A SCIENCE CORE REQUIREMENT

Meet Requirement?	f	%
Yes	94	94
No	3	3
N/A*	3	3
Total	100	100

* Not applicable.

Table 6 indicates that only seven percent of the respondents had prerequisites for nonmajor biology courses, and only one of these had a college course prerequisite. The list of prerequisites is given in Appendix E.

TABLE 6. NUMBER OF NONMAJOR BIOLOGY COURSES THAT HAVE PREREQUISITES

Prerequisites?	f	%
Yes*	7	7
No	51	51
N/R	42	42
Total	100	100

* Listed in Appendix E.
N/R - no response

The student enrollment in the courses was primarily located in the lower enrollment groupings. The lowest grouping, one to 50 students, had 35 percent of the courses. The next two groupings, 51 to 100 and 101 to 105, had 35 percent; the remaining 30 percent were in the higher six groupings. For complete data refer to Table 7.

TABLE 7. ANALYSIS OF ENROLLMENT IN NONMAJOR BIOLOGY COURSES

Student Enrollment	f	%
1 - 50	35	35
51 - 100	22	22
101 - 150	13	13
151 - 200	6	6
201 - 250	5	5
251 - 300	4	4
301 - 600	9	9
601 - 800	--	--
Over 800	6	6
N/R	--	--
Total	100	100

N/R - No response.

These courses were only one semester or quarter in length 75 percent of the time. There were 16 percent with a two semester or quarter sequence, and only one percent with a three semester sequence. The data on length of nonmajor biology courses are presented in Table 8.

TABLE 8. ANALYSIS OF LENGTH OF NONMAJOR BIOLOGY COURSES

Length	f	%
one semester/quarter only	75	75
one part of two semesters/quarters*	5	5
both parts of two semesters/quarters	11	11
three parts of three semesters/ quarters course	1	1
length of course not given	8	8
Total	100	100

* Questionnaire and syllabus sent for each covered only one half of course.

Most of the institutions responding, 79 percent, were on the semester system with only 11 percent on the quarter system. Three of the 10 institutions that did not respond indicated they used a trimester system. Courses were most frequently in the three to four (45 and 38 percent) hour category. Only 17 percent possessed different credit hours. The combined data are represented in Table 9.

TABLE 9. ANALYSIS OF CREDIT HOURS PER SEMESTER/QUARTER OF NONMAJOR BIOLOGY COURSES

Number of Hours	Semester f	Semester %	Quarter f	Quarter %	Total f	Total %
1	1	1	--	--	1	1
2	--	--	--	--	--	--
3	43	43	2	2	45	45
4	32	32	6	6	38	38
5	2	2	1	1	3	3
6	1	1	2	2	3	3
Not given or on different system	10	10	--	--	10	10
Total	89	89	11	11	100	100

The courses were examined for presence of lecture, laboratory, discussion, and audiotutorial components. Lecture was the most popular, existing in 96 percent of the courses. More than half these courses, 55 percent, contained a laboratory. Discussion sections and audiotutorial components, usually in place of lecture, were present in a very small number of courses. The complete data regarding course format are in Table 10.

TABLE 10. ANALYSIS OF COURSE FORMAT OF NONMAJOR BIOLOGY COURSES

Course Component	Yes f	Yes %	No f	No %	N/A f	N/A %	N/R f	N/R %	Total f	Total %
Lecture	96	96	1	1	2	2	1	1	100	100
Laboratory	55	55	40	40	0	0	5	5	100	100
Discussion	17	17	65	65	5	5	13	13	100	100
in place of lab	1	1	12	12	56	56	31	31	100	100
in place of lecture	5	5	11	11	57	57	27	27	100	100
Audiotutorial	10	10	65	65	6	6	19	19	100	100
in place of lab	2	2	13	13	56	56	29	29	100	100
in place of lecture	6	6	14	14	56	56	24	24	100	100

N/A - Not applicable.
N/R - No response.

When institutional control type was compared with coures components, Independent: Private institutions had the fewest laboratories (26 percent), while Independent: Religious had the most (76 percent). Discussion sections and audiotutorial components were not present in any of the Independent: Roman Catholic institutions. This data is found in Appendix F.

The format of the courses was analyzed by the amount of hours spent in each part. Lectures were given three hours per week in 69 percent of the courses, while laboratory was either three (24 percent) or two (20 percent) hours and discussion one hour long (11 percent). This information is shown in Table 11.

TABLE 11. ANALYSIS OF CLASS TIME OF NONMAJOR BIOLOGY COURSES

	Number of courses					
	Hours/week for lecture		Hours/week for lab		Hours/week for discussion	
Frequency of classes	f	%	f	%	f	%
0	2	2	15	15	16	16
1	1	1	8	8	11	11
2	23	23	20	20	2	2
3	69	69	24	24	3	3
4	2	2	1	1	1	1
5	1	1	--	--	--	--
N/A	2	2	28	28	53	53
N/R	--	--	4	4	14	14
Total	100	100	100	100	100	100

N/A - Not applicable.
N/R - No response.

The enrollment in 33 of the laboratory sections was between 21 and 40 students, while 18 others had laboratories containing one to 20 students. For discussion sections seven courses had an enrollment of one to 20 students, while eight others had 21 to 40 students. The above information is presented in Table 12.

TABLE 12. ANALYSIS OF ENROLLMENT IN EACH LABORATORY AND DISCUSSION SECTION IN NONMAJOR BIOLOGY COURSES

Student enrollment	Laboratory section f	Laboratory section %	Discussion section f	Discussion section %
1 - 20	18	18	7	7
21 - 40	33	33	8	8
41 - 60	2	2	--	--
Over 60	--	--	1	1
N/R	2	2	1	1
N/A	45	45	83	83
Total	100	100	100	100

N/R - No response.
N/A - Not applicable.

Goals and Emphases of Nonmajor Biology Courses. Question eight on the questionnaire asked each respondent to state the major goals of their course, provided it was not included in their syllabus. The major goals of each course were obtained from these two sources. Goals were not given for 23 institutions because they were on syllabi that were never received or did not contain goals. The 77 respondents that listed their major goals were compared to a previously prepared list of goals. The list, containing 14 general areas, was developed as a condensed version of all goals received. Those goals that were ranked other are shown in Appendix G. A total of 172 goals were mentioned as multiple answers were possible. The six goals mentioned by more than 10 respondents are listed in order of highest to lowest response as follows:

1. To understand biological principles and concepts. (29 percent)
2. To understand the anatomy, physiology, and/or genetics of the human organism. (29 percent)
3. To understand the interactions in the biosphere and man's role in it. (17 percent)
4. To understand biosocial and/or bioethical issues and how they relate to the individual and society. (15 percent)
5. To increase the scientific literacy of students. (15 percent)
6. To understand and/or apply the scientific method. (14 percent)

By grouping goals one and two on Table 13 the understanding of biological principles and concepts ranked highest at 39 percent. The complete information on course goals is located in Table 13.

TABLE 13. ANALYSIS OF MAJOR GOALS OF NONMAJOR BIOLOGY COURSES

Goal	Yes f	Yes %	No f	No %	No goals listed f	No goals listed %	Total f	Total %
1. To understand biological principles and concepts including interrelationships at all biological levels of organization.	29	29	48	48	23	23	100	100
2. To learn biological principles through study of contemporary biological problems, issues, and topics.	10	10	67	67	23	23	100	100
3. To understand biosocial and/or bioethical issues and how they are related to the individual and society.	15	15	62	62	23	23	100	100
4. To understand the anatomy, physiology, and/or genetics of the human organism.	29	29	48	48	23	23	100	100
5. To increase the scientific (biological) literacy of students.	15	15	62	62	23	23	100	100
6. To be aware of the historical developments of biology and the scientists involved in the developments.	1	1	76	76	23	23	100	100
7. To understand the interactions in the biosphere and man's role in it.	17	17	60	60	23	23	100	100
8. To recognize the natural environment is unique and needs preservation.	4	4	73	73	23	23	100	100
9. To appreciate the uniqueness and/or diversity of life.	8	8	69	69	23	23	100	100
10. To understand and/or apply the scientific method (process).	14	14	63	63	23	23	100	100

TABLE 13. (Continued)

Goal	Yes		No		No goals listed		Total	
	f	%	f	%	f	%	f	%
11. To understand the philosophy of science	3	3	74	74	23	23	100	100
12. To be able to evaluate scientific data.	1	1	76	76	23	23	100	100
13. To discover relationship between the Christian religion and science.	3	3	74	74	23	23	100	100
14. To provide the basics of biology needed for future biology courses and/or encourage a career in the biological sciences.	2	2	75	75	23	23	100	100
15. Other*	21	21	56	56	23	23	100	100
Total	Multiple choices possible							

* For listing of other goals mentioned see Appendix G.

Question 13 in the questionnaire asked respondents to rank the areas of the course according to emphasis with one being most emphasized and five least. Another choice was not included. Several respondents gave the same ranking to some of the areas. A few who did not rank certain areas explained them as very little emphasized. As indicated in Table 14, the area with the highest ranking was biological concepts and principles with 460 points. Of the respondents 77 gave it a number one ranking. Applied biology with 291 points was ranked second followed closely by biosocial issues with 283 points. The area of problem solving skills was ranked fourth with 218 points, and 25 respondents ranked it number five. It was covered very little or not at all by 14 respondents. Personal evaluation of biosocial issues was ranked fifth with 175 points and covered very little or not at all by 21 respondents.

TABLE 14. COMPARISON OF COURSE EMPHASES IN NONMAJOR BIOLOGY COURSES

Ranking 1 most emphasis to 5 least emphasis	Biological concepts & principles			Applied biology			Problem solving skills (scientific method)			Biosocial issues			Personal evaluation of biosocial issues		
	f	Points	%	f	Points	%	f	Points	%	f	Points	%	f	Points	%
1 (5 pts.)	77	385	77	13	65	13	6	30	6	10	50	10	2	10	2
2 (4 pts.)	14	56	14	33	132	33	15	60	15	27	108	27	9	36	9
3 (3 pts.)	4	12	4	16	48	16	23	69	23	23	69	23	22	66	22
4 (2 pts.)	3	6	3	18	36	18	17	34	17	27	54	27	17	34	17
5 (1 pt.)	1	1	1	10	10	10	25	25	25	2	2	2	29	29	29
Not included	1	--	1	5	--	5	12	--	12	8	--	8	16	--	16
No response	--	--	--	3	--	3	1	--	1	1	--	1	3	--	3
Very little	--	--	--	2	--	2	1	--	1	2	--	2	2	--	2
Total*	100	460	100	100	291	100	100	218	100	100	283	100	100	175	100

* Totals across do not add up to 100 due to some institutions ranking some areas the same-eg. two with 1 ranking and three with 2 ranking.

Materials Used in Nonmajor Biology Courses. Questions were asked concerning required textbooks, laboratory manuals, and supplementary readings, as well as audiovisual materials used in the course. Respondents were required to list the author, titles and publishers of each of the required materials. Books in Print was used to supplement any incomplete information given for the textbooks.

Textbooks were required in 89 percent of the courses. Yet supplementary readings were required in only 28 percent of the courses. The data are included in Table 15.

TABLE 15. ANALYSIS OF MATERIALS REQUIRED FOR NONMAJOR BIOLOGY COURSES

Materials required	Yes		No		N/A		N/R		Total	
	f	%	f	%	f	%	f	%	f	%
Textbook	89	89	5	5	0	0	6	6	100	100
Supplementary reading	28	28	71	71	0	0	1	1	100	100

N/A - not applicable
N/R - no response

There were 57 different textbooks used by the 100 courses. Of these, 40 were used by only one course. The textbook used most often was Invitation to Biology by Curtis and Barnes, and that was used in only seven courses. A complete list of textbooks in order of frequency of use is found in Appendix H.

Supplementary readings were divided into four types: popular media and scientific journal articles on reserve in libraries, Scientific American Offprints, study guides (some were optional), and paperback books. Articles on reserve were used most often by 13 respondents as indicated in Table 16. A complete list of supplementary readings mentioned by respondents is found in Appendix I.

TABLE 16. ANALYSIS OF SUPPLEMENTARY READINGS REQUIRED BY NONMAJOR ONLY BIOLOGY COURSES

Type	Number of courses f
Media and scientific journal articles on reserve	13
Scientific American Reprints	4
Study guides	6
Paperback books	10
Total*	33

* Some respondents mentioned more than one type of supplementary readings. See Appendix I for complete list of supplementary readings.

Laboratory manuals were required in 41 of the 55 courses with laboratory. As shown in Table 17 the manuals were almost evenly divided between those published and those prepared by the course professor. Appendix J, Table 38 includes the list of required laboratory manuals.

TABLE 17. ANALYSIS OF LABORATORY MANUALS REQUIRED FOR NONMAJOR BIOLOGY COURSE

Type	Yes - Published		Yes - Dept.		No		N/A		N/R		Total	
	f	%	f	%	f	%	f	%	f	%	f	%
Lab manual	22	22	19	19	14	14	43	43	2	2	100	100

N/A - not applicable
N/R - no response

Audiovisual materials were used all the time, very frequently, or moderately by 72 percent of the respondents. Only three percent did not use them. This data is presented in Table 18.

TABLE 18. FREQUENCY OF USE OF AUDIOVISUAL MATERIALS IN NONMAJOR BIOLOGY COURSES

Amount of use	f	%
Used at all times	15	15
Used very frequently	28	28
Moderately used	29	29
Occasionally used	25	25
Not used at all	3	3
Total	100	100

Question 12 in the questionnaire asked respondents to indicate what type of audiovisual materials they used most frequently. The three most frequent responses were 35 mm slides, 16 mm films (movies), and transparencies. Complete data are included in Table 19. A list of the other audiovisual materials is in Appendix K.

As shown in Appendix L, Table 39, a comparison was made to detect any correlation between the size of course enrollment and audiovisual use. The three lower enrollment groups to 150 students had close agreement with overall audiovisual use. The two groups, 151-200 and 201-250, used audiovisuals less frequently than the average; while the group greater than 800 used it more frequently. No overall pattern was evident.

TABLE 19. TYPES OF AUDIOVISUAL MATERIALS USED MOST FREQUENTLY IN NONMAJOR BIOLOGY COURSES*

Type of material	Yes		No		None listed		Total	
	f	%	f	%	f	%	f	%
16 mm films	55	55	40	40	5	5	100	100
film strips	8	8	87	87	5	5	100	100
overhead projector-transparencies	38	38	57	57	5	5	100	100
35 mm slides	60	60	35	35	5	5	100	100
slide cassette	7	7	88	88	5	5	100	100
video tapes	10	10	85	85	5	5	100	100
audiotutorial	3	3	92	92	5	5	100	100
film loops	8	8	87	87	5	5	100	100
maps, charts, models	5	5	90	90	5	5	100	100
blackboard	2	2	93	93	5	5	100	100
other+	5	5	90	90	5	5	100	100

* Multiple choices possible
+ Listed in Appendix K.

Analysis of Provisions for Exceptional Students. Most respondents stated that they had no special provisions for the handicapped (61 percent) or honor students (79 percent). This data is shown in Table 20. For a description of special provisions for handicapped and honor students listed by respondents see Appendix M. For handicapped students, individualized attention was indicated through use of tutors, special equipment, special testing procedures, video tapes, audio tapes, and readers.

TABLE 20. ANALYSIS OF PROVISIONS FOR EXCEPTIONAL STUDENTS IN NONMAJOR BIOLOGY COURSES*

Student type	Yes		No		N/A		N/R		Total	
	f	%	f	%	f	%	f	%	f	%
Handicapped	24	24	61	61	6	6	9	9	100	100
Honor students	8	8	79	79	4	4	9	9	100	100

* Comments listed in Appendix M.
N/A - not applicable
N/R - no response

Respondents Planning Major Revision of Course. There were 13 respondents (13 percent) who indicated they planned a revision of their nonmajor biology course before 1983. The data are presented in Table 21.

TABLE 21. NUMBER OF INSTITUTIONS PLANNING MAJOR REVISION OF NONMAJOR BIOLOGY COURSE BEFORE 1983

Plan revision?	f	%
Yes	13	13
No	83	83
N/A	4	4
Total	100	100

N/A - not applicable.

Analysis of Nonmajor Biology Course Syllabi

Of the 100 respondents with nonmajor biology courses, 62 sent syllabi for their courses used to complete the questionnaire. The information in these syllabi varied from a simple listing of contents to a complete course description of major goals, specific objectives, procedures, evaluation and grading scale, and content. The most important and complete information of the syllabi analysis was in the areas of lecture examinations, lecture content, and laboratory content.

Analysis of Lecture Examinations. Preliminary lecture examinations were given in 53, or 85 percent, of the courses. A final examination was given in 38, or 61 percent, of the courses, of which only 11, or 18 percent were comprehensive. Data regarding lecture examinations are presented in Table 22.

TABLE 22. ANALYSIS OF LECTURE TESTS OF NONMAJOR BIOLOGY COURSES WITH SYLLABI

Descriptor	Preliminary lecture tests f	Preliminary lecture tests %	Makeups allowed f	Makeups allowed %	Final given f	Final given %	Final comprehensive f	Final comprehensive %
Yes	53	85	15	24	38	61	11	18
No	2	3	5	8	15	24	8	13
N/G	4	7	38	61	6	10	25	40
N/A	3	5	4	7	3	5	18	29
Total	62	100	62	100	62	100	62	100

N/G - not given on syllabi.
N/A - not applicable.

The number of preliminary lecture examinations given most often was three in 24, or 39 percent of the courses. This is shown in Table 23.

TABLE 23. NUMBER OF PRELIMINARY LECTURE TESTS GIVEN IN NONMAJOR BIOLOGY COURSES WITH SYLLABI

Number of tests	f	%
1	7	11
2	6	10
3	24	39
4	12	19
5	3	5
6	1	1
More than 6	--	--
N/G	3	5
N/A	6	10
Total	62	100

Analysis of Lecture Content. The content of each course was examined to determine the number of weeks spent on each topic. Of the 62 courses with syllabi, one did not give the content covered in the course, and 13 did not identify the time spent on the topics. Over three fourths of the courses included seven topics as listed below:

1. Mendelian genetics - 58 or 94 percent.
2. Cell biology - 57 or 92 percent.
3. Human biology (anatomy, physiology, reproduction and/or development) - 55 or 89 percent.

4. Evolution - 52 or 84 percent.
5. Molecular genetics -- 51 or 82 percent.
6. Reproduction (plant and/or animal) - 48 or 77 percent.
7. Ecology - 47 or 76 percent.

The topics least covered were creationism (3 or 5 percent), population genetics (14 or 23 percent), and animal anatomy and physiology (14 or 23 percent). The complete data regarding course content are presented in Table 24. A list of other lecture content mentioned in Table 24, as well as applied biology and biology issues mentioned in some syllabi, are found in Appendix N.

TABLE 24. ANALYSIS OF LECTURE CONTENT OF NONMAJOR BIOLOGY COURSES WITH SYLLABI

Topic	Approximate number of weeks < 1		1-2		2^+- 3		3^+- 4		4^+- 5		5^+- 6		> 6		N/I**		N/G**		Present, time not indicated		Total	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Science - Scientific method	7	11	5	8	--	--	--	--	--	--	--	--	--	--	47	76	1	2	2	3	62	100
Cell biology	4	6	16	26	7	11	4	7	2	3	--	--	1	1	16	26	1	2	11	18	62	100
Reproduction (plant & animal)	17	27	7	11	4	6	1	2	--	--	--	--	--	--	23	37	1	2	9	15	62	100
Development (plant & animal)	9	14	1	2	2	3	--	--	--	--	--	--	--	--	46	74	1	2	3	5	62	100
Survey of kingdoms (taxonomy)	10	16	4	6	1	2	2	3	--	--	--	--	--	--	36	58	1	2	8	13	62	100
Animal anatomy and physiology	2	3	1	1	2	3	1	2	1	2	2	3	--	--	50	81	1	2	2	3	62	100
Plant anatomy & physiology	3	5	4	6	5	8	1	2	--	--	--	--	--	--	41	66	1	2	7	11	62	100

**N/I - Topic not included in course.
N/G - Topics not given for one syllabus.

TABLE 24. (Continued)

Topic	Approximate number of weeks														N/I**		N/G**		Present, time not indicated		Total	
	< 1		1-2		2^+- 3		3^+- 4		4^+- 5		5^+- 6		> 6									
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Human biology (anatomy, physiology, reproduction, & development	4	6	6	10	5	8	3	5	3	5	5	8	10	16	16	26	1	2	9	14	62	100
Bacteria, viruses & immunology	16	26	3	5	--	--	1	1	--	--	--	--	--	--	41	66	1	2	--	--	62	100
Mendelian genetics	16	26	13	21	2	3	--	--	--	--	--	--	--	--	17	27	1	2	13	21	62	100
Molecular genetics	9	14	19	31	2	3	--	--	--	--	--	--	--	--	21	34	1	2	10	16	62	100
Human genetics	12	19	12	19	--	--	1	2	--	--	1	1	--	--	29	47	1	2	6	10	62	100
Population genetics	5	8	2	3	--	--	--	--	--	--	--	--	--	--	51	82	1	2	3	5	62	100
Ecology	5	8	16	26	5	8	2	3	2	3	--	--	--	--	23	37	1	2	8	13	62	100
Human ecology (conservation)	7	11	10	16	3	5	--	--	--	--	1	1	--	--	37	60	1	2	3	5	62	100
Evolution - origin of life	10	16	23	37	3	5	1	2	--	--	--	--	--	--	17	27	1	2	7	11	62	100

TABLE 24. (Continued)

	Approximate number of weeks																					
Topic	< 1		1-2		2^+- 3		3^+- 4		4^+- 5		5^+- 6		> 6		N/I**		N/G**		Present, time not indicated		Total	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Creationism	2	3	--	--	--	--	--	--	--	--	--	--	--	--	59	95	1	2	--	--	62	100
Adaption, behavior, & sociobiology	5	8	7	11	--	--	--	--	--	--	--	--	--	--	47	76	1	2	2	3	62	100
Other*	3	5	2	3	2	3	--	--	--	--	--	--	1	1	52	84	1	2	1	2	62	100

* See appendix N for other topics covered.

Analysis of Laboratory Content. Only 36 or 58 percent of the courses with syllabi had a laboratory component. As indicated in Table 25 only 21 of these listed the laboratory content.

TABLE 25. ANALYSIS OF LABORATORY FOR NONMAJOR BIOLOGY COURSES WITH SYLLABI

Descriptor	Number of courses Yes f	 %	 No f	 %	 Total f	 %
Laboratory present	36	58	26	42	62	100
Topics listed	21	34	41	66	62	100

From a list of 20 lab topics only four were included in more than half of the courses. These were cell biology, genetics, ecology, and mitosis and meiosis. When considering all types of anatomy labs, anatomy was mentioned in 95 percent of the courses. Lab topics listed as other are found in Appendix O. These include labs requiring the use of the scientific method. Data regarding laboratory content are given in Table 26.

TABLE 26. ANALYSIS OF LABORATORY CONTENT OF NONMAJOR BIOLOGY COURSES WITH SYLLABI

	Number of labs											
Topic	1 or less		2		3		4 or more		Not included		Total	
	f	%	f	%	f	%	f	%	f	%	f	%
Use of microscope	9	43	--	--	--	--	--	--	12	57	21	100
Cell biology	5	24	6	29	4	19	2	9	4	19	21	100
Mitosis, meiosis	9	43	3	14	--	--	--	--	9	43	21	100
Dissection of fetal pig	--	--	--	--	3	14	3	14	15	72	21	100
Animal anatomy	5	24	1	5	--	--	2	9	13	62	21	100
Plant anatomy	7	33	1	5	--	--	1	5	12	57	21	100
Animal physiology	3	14	1	5	1	5	--	--	16	76	21	100
Plant physiology	2	10	--	--	--	--	--	--	19	90	21	100
Human anatomy	3	14	1	5	1	5	1	5	15	71	21	100
Human physiology	2	10	3	14	--	--	2	9	14	67	21	100
Reproduction plants & animals	6	29	3	14	--	--	--	--	12	57	21	100
Human reproduction	1	5	1	5	--	--	--	--	19	90	21	100
Development plants & animals	6	28	1	5	--	--	1	5	13	62	21	100

TABLE 26. (Continued)

Topic	Number of labs											
	1 or less		2		3		4 or more		Not included		Total	
	f	%	f	%	f	%	f	%	f	%	f	%
Human development	--	--	--	--	--	--	--	--	21	100	21	100
Genetics (Mendelian population, molecular)	12	57	2	9	1	5	1	5	5	24	21	100
Human genetics	6	28	1	5	--	--	--	--	14	67	21	100
Ecology and adaptation	8	38	1	5	1	5	3	14	8	38	21	100
Evolution	4	19	--	--	--	--	--	--	17	81	21	100
Survey of organisms (taxonomy)	1	5	1	5	2	9	3	14	14	67	21	100
Other topics*	5	24	--	--	--	--	1	5	15	71	21	100
Field trips	5	24	3	14	--	--	1	5	12	57	21	100

* Other topics listed in Appendix O.

Subjective Analysis of Courses. The courses were subjectively analyzed using the questionnaires and syllabi to determine if any met the desired goals, obtained from the literature, for a nonmajor biology course. The two major goals selected were:

1. to produce scientifically literate students as defined in this study.
2. to develop students' critical thinking skills as stated in _Science for Non-Specialists: The College Years_. (xvii)

Only eight of the 62 courses were rated highly satisfactory on the basis of their goals, and methods and content used to reach those goals. Included in these courses were a laboratory in each, five lasting three hours, two lasting two hours, and one audiotutorial. Four courses had discussion sections and one included a weekly one hour film series. Half of the courses required written and/or oral reports in laboratory or discussion sections. The 14 courses ranked satisfactory were considered weak in one area or another. The rest of the courses, 40, were ranked mixed, unsatisfactory, or highly unsatisfactory. They often stressed understanding biological concepts and principles or applied human biology, but included little else. The rankings are shown in Table 27.

TABLE 27. SUBJECTIVE ANALYSIS OF NONMAJOR BIOLOGY COURSES WITH SYLLABI TO SEE IF THEY MEET SPECIFIED GOALS*

	Highly satisfactory	Satisfactory	Mixed	Unsatisfactory	Highly unsatisfactory	Total
Number of courses	8	14	22	17	1	62

* Goals of scientific literacy for students and development of students' critical thinking skills as defined in study.

Analysis of Respondents Without Nonmajor Biology Courses

Question two was the only question answered by these respondents. The syllabi sent by them were not analyzed for this study but were given to the biology department at Saint Mary's College for further study.

Of the 34 respondents without a nonmajor biology course, 31 or 91 percent offered a combined major and nonmajor biology course. Although not shown in any table, 131 or 98 percent of the institutions had a biology course in which nonmajors could enroll. Of the 34 respondents, 21 or 62 percent said the institution offered other nonmajor science courses. The titles of these courses are listed in Appendix P. Data concerning science courses for nonmajors at institutions without nonmajor biology courses are located in Table 28.

TABLE 28. ANALYSIS OF SCIENCE COURSES FOR NONSCIENTISTS FROM RESPONDENTS WITHOUT NONMAJOR BIOLOGY COURSES

Courses present?	Combined major & nonmajor biology f	%	Other nonmajor science courses* f	%
Yes	31	91	21	62
No	2	6	9	26
N/A	--	--	--	--
N/R	1	3	4	12
Total	34	100	34	100

* The titles of other nonmajor science courses listed in questionnaires are presented in Appendix P.

Science core requirements of these respondents are given in Appendix P, Table 40. Of the 34 institutions responding, 26 had science core requirements of eight credit hours. A total of 65 percent had eight or less credit hours for their science core requirements.

Analysis of Comments

Comments Concerning Course Structure. Comments were invited about course structure and edited versions are listed in Appendix Q. The following are comments referring to the laboratory sections:

1. Optional lab meetings are given three or four times

per semester. (2)

2. I have introduced a one hour lab and/or discussion which meets about every third week. I would like to have it meet every other week. (8)
3. Students may enroll in a lab section that accompanies this course, if they wish, for one hour of credit. (11)
4. Our nonmajor course has a separate lab course for certain students, such as nursing and physical education majors. This is a two hour credit course meeting three hours a week. (22)

Respondents also mentioned that science core requirements for their institutions were being or had just been revised. (6, 12,19b) One of these (12) stated a laboratory course was now required.

Other Comments. The end of the questionnaire solicited other comments which are listed in Appendix R along with comments written in the margins on the questionnaire. Selected important comments are listed below:

1. For our purposes I think the lab manual is excellent. (Kaplan, Experiences in Life Science) Not all students would agree because there can be lots of frustration for those who refuse to think. (3)
2. In lab we do have a computer simulation of pond ecology. Each student gets hands on experience with a PET microcomputer. (4a)

3. I suggest you consider the process of science as part of your new look.... (11c)
4. I plan a lab revision next to develop better correlation to course objectives ... I will be able to incorporate computer literacy concepts. (12b)
5. Until recently the course was audiotutorial. The course has been redesigned towards a more traditional lecture and laboratory format. (22)
6. The course as taught recently will be changed next year from a classical biology course to a current topics, man and his environment course. (23)
7. This is a new course, less than two years experience. It is therefore still developing. (25)

CHAPTER IV

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The summary has been divided into four sections. The purpose of the study is reviewed and procedure outlined. The principle points of the review of literature are stated and the findings of the study summarized.

Purpose. The major purpose of this study was to acquire information about the availability, type, format, goals and emphases, and content of nonmajor biology courses in the United States and Canada. The information was meant for general use by educators interested in science for the nonscience major, and for specific use by professors at Saint Mary's College to aid in a revision of a two semester nonmajor biology course.

Procedure. A questionnaire was sent to 300 colleges and universities in the United States and Canada. The sample was randomly selected from a population of 1,200 four-year institutions offering a bachelor's degree in biological sciences as listed in *Peterson's Annual Guide to Undergraduate Education 1981*. The questionnaire requested copies of syllabi from any science courses for nonscience majors that the respondents offered. A follow-up post card was sent approximately one month later to increase the returns. Only the syllabi received from the nonmajor biology courses used to answer the majority of the questionnaire were analyzed using the Syllabus Content Forms.

Review of Literature. Literature concerning nonmajor biology courses was divided into three areas. The first area was a description of innovative courses which usually used audiotutorial methods and stressed students' achieving scientific literacy. The second area was mostly general opinion articles deploring the present state of science courses for the nonscientist at all educational levels. They advised revising nonmajor science courses to aid the nonscientist in attaining scientific literacy needed for living in our democratic, scientific, and technological society. The final area included surveys of nonmajor science courses. Two surveys of first-year biology courses indicated a wide variety of nonmajor, general and topics courses available. An unpublished report by Wright showed nine out of the 12 universities surveyed had a laboratory science course core requirement.

In 1982 a major report was published, Science for Non-Specialists: The College Years. It stated that although 90 percent of the institutions had a science core requirement, nine was the average number of credit hours required (seven percent of course load). The choice of nonmajor science courses to fulfill that requirement included topics courses which often failed to provide students with an understanding of the basic principles of science. One of the recommendations of the study was to implement nonmajor science courses that would develop the students' critical thinking abilities and scientific literacy.

Findings. From the sample of 300 institutions, 134 or 45 percent responded. The following is a description of responding institutions:

1. Institutional control was 63 percent independent and 37 percent public.
2. Undergraduate enrollment was mainly grouped in two areas, 501-1,500 at 40 percent and 2,001-6,000 at 30 percent.
3. They were coeducational. (96 percent)
4. Most awarded master's degrees or higher. (64 percent)
5. They had core requirements. (95 percent)

Of the 134 respondents, 100 had at least one nonmajor biology course and answered the questionnaire based on their most general course. Syllabi were sent for 62 of the 100 courses.

The total number of titles for nonmajor biology courses was 186 with 31 percent of these general biology titles. The rest were mostly topics courses divided into eleven areas. The nonmajor biology courses used to answer the questionnaire were 60 percent general courses.

There was considerable information obtained about the 100 nonmajor biology courses. Most of them could be used to help meet science core requirements, while the majority also lacked prerequisites. The course enrollment was often at the lower end of the rankings with 35 percent in the one to 50 student group. Most were one semester, three or four credit hour courses. The courses' formats were as follows:

1. Lecture - 96 percent given three hours per week.
2. Laboratory - 55 percent for three or two hours per week with 21 to 40 students in each section.
3. Discussion - 17 percent usually for one hour a week with either 1-20 or 21-40 students in each section.
4. Audiotutorial - 10 percent usually used in place of lecture.

Of the wide variety of goals proclaimed for the 100 courses, the three most popular were to understand the biological principles and concepts (29 percent); to understand human biology (29 percent); and to understand the interactions of the biosphere and man's role in it (17 percent). The goal to increase scientific literacy was mentioned by 15 percent. Only 14 percent stated understanding and/or applying the scientific method as a goal.

Respondents ranking areas of emphasis in their courses rated biological concepts and principles as the highest.

Applied biology and biosocial issues were close together with the second and third highest rankings respectively. Problem solving skills was fourth and personal evaluation of biosocial issues was fifth highest.

The required materials used in the courses were most often a textbook. In the 100 courses, 56 different textbooks were used. The most frequent was Invitation to Biology by Barnes and Curtis used by only 7 percent. Supplementary readings were required by only 28 percent of the courses. Laboratory manuals, evenly divided between published manuals and manuals written by course professor, were required by most of the courses with a laboratory. Audiovisual materials especially slides, movies, and transparencies, were used moderately or more by 72 percent of the courses.

Other information from the 100 nonmajor biology courses concerned exceptional students and course revision. Only a quarter of the courses had provisions for the handicapped and very few mentioned arrangements for honor students. A total of 13 percent of the respondents indicated they planned a major revision of their course before 1983.

As a result of variation in syllabi, analysis of the 62 syllabi was limited to lecture examinations, lecture content and laboratory content. Preliminary lecture tests, usually three, were given in 85 percent of the courses. A final examination, usually not comprehensive, was given in only 61 percent of the courses. The lecture topics that were usually included were Mendelian genetics, cell biology, human biology, evolution, molecular genetics, reproduction (plant and/or animal), and ecology. Laboratory, present in 58 percent of these courses, listed the following topics over 50 percent of the time: cell biology, genetics, ecology and adaptation, and mitosis and meiosis.

The 62 courses were also examined using both questionnaire and syllabi. Only eight of the courses were subjectively ranked as very satisfactory in reaching the goals of development in students of scientific literacy and critical thinking.

The 34 respondents without nonmajor biology courses offered a combined majors/nonmajors biology course 91 percent of the time. Other nonmajor science courses were offered at 21 of these institutions.

Comments concerning course format indicated a laboratory component was desirable, and science core requirements were in a state of change. General comments depicted that nonmajor biology courses were also in a state of change as institutions searched for improved methods to better educate the nonscience major.

Conclusions

Studies by Kormondy and others, Kastrinos and Teriziotti, and Science for Non-Specialists: The College Years, presented a wide variety of nonmajor, general and topics, biology courses. This study corroborated these findings. In this study, 186 nonmajor biology courses were present in 75 percent or 100 of the institutions surveyed. In addition 91 percent of the other 34 institutions offered a combined major and nonmajor course. Consequently, nonscience majors have the opportunity to take a biology course in a great majority of the colleges and universities in the United States and Canada.

In considering the 100 courses used to answer the questionnaire, 60 percent were general courses. The vast majority of these courses were able to help satisfy the science core requirements of the institution. From examining these courses, including the 62 with syllabi, a description of the typical nonmajor biology course was formulated.

The typical nonmajor biology course which emerged from this study had no prerequisites and was a one semester, three or four hour course. The student enrollment was between one to 50 or 51 to 100. The format was lecture three times per week and a traditional laboratory with an enrollment between 21 and 40 students. There was no discussion or audiotutorial components in the course. The goals were to understand biological principles and concepts, and human biology. Most of the emphasis was placed on concepts and principles. A textbook was required but no single textbook emerged as the most predominant. The laboratory manual was either published or written by the course professor; and no supplementary readings were required. Audiovisual materials were either used moderately or very frequently and consisted of slides, movies, and transparencies. There were no provisions for the handicapped or honor students. Evaluation in lecture consisted of three preliminary examinations and a final examination. The lecture topics were variable but included Mendelian genetics, cell biology, human biology, evolution, molecular genetics, ecology, and plant and animal reproduction. Lab topics were cell biology, genetics, ecology and adaptation, mitosis and meiosis, and anatomy.

The generalized course described above would not meet the desired goal of Brovey and Yager to produce scientifically literate citizens. It also would not satisfy the goal of Science for Non-Specialists: The College Years and Dean to develop critical thinking (problem solving) skills in students. Specifically this study found only 15 percent of the respondents desired to increase the scientific literacy of their students. A related goal, to understand biosocial and/or bioethical issues and how they are related to the individual and society, was mentioned by 15 percent of the respondents. The goal of understanding and/or applying the scientific method had only 14 percent response. Problem solving skills were ranked fourth in course emphasis. Only 21 percent considered it worthy of a number one or two ranking. Consideration of biosocial issues was given more emphasis but was ranked in third place, far below concepts and principles and applied biology. The goals and emphases of a majority of the nonmajor biology courses differed from those preferred by science educators.

Most of the innovative courses reviewed in the literature had an audiotutorial component and were designed to attain the goal of a scientifically literate citizenry. (Barman, Lynch, Druger) Audiotutorial components were found in only 10 percent of the study's respondents. Of the eight nonmajor biology courses subjectively ranked as highly satisfactory, only one had an audiotutorial laboratory. It had an enrollment of 3,000 students per year. Another respondent remarked that they had abandoned the audiotutorial method for a more traditional lecture and laboratory format. (Appendix R, 22, p.141) The auditotuorial method, so often described in literature, was not frequently used in nonmajor biology courses and is only one alternative for reaching the desired goal of scientific literacy for students.

There was support for a core requirement of a laboratory science course as stated by Reeves and shown in the unpublished survey by Wright. The eight courses subjectively ranked highly satisfactory all contained a laboratory component. One respondent mentioned their science core requirement had been recently revised to include a laboratory requirement. (Appendix Q, 12, P.135) Another stated their science core requirements were in the process of change in order to require a laboratory science. (Appendix Q, 6, p.134)

There should be a laboratory component to a general nonmajor biology course in order to best enable students to develop critical thinking skills. Also, a laboratory science course should be a part of the science core requirement.

Nonmajor biology courses are in a state of change as evidenced by: the wide variety of courses presently offered; courses that have recently or are in the process of change (Appendix R, 6,12b.,22,25); courses that will be revised which were 13 percent of the respondents; the numerous textbooks used; and the diverse assortment of goals and content. The subjective indications of this study are that a few courses have already met, and some are in the process of changing to meet, the goals presented in the review of literature to produce scientifically literate students capable of thinking critically.

Recommendations

General recommendations for educators responsible for nonmajor biology courses are:

1. Each course should be carefully evaluated to see if its goals and methods are meeting the needs of the nonscientist as stated in the literature.
2. One of the nonmajor biology courses offered at each institution should be a general course with the laboratory as an integral part of the course. Prefer-

ably the institution should have a laboratory science core requirement.

3. The laboratory should have, as its major goal, the development of students' critical thinking skills and understanding the nature of science by using the scientific method.
4. Scientific literacy for students should also be a major goal of the course requiring more emphasis on biosocial issues.

Listed below are specific recommendations for the general nonmajor biology course at Saint Mary's College:

1. Perusal by the teaching team of all the syllabi received, with special attention focused on the eight courses ranked highly satisfactory in meeting the goals of scientific literacy and critical thinking, for specific suggestions.
2. Further study of those eight courses, including follow-up contact with the instructors.
3. The laboratory section of the course should be strengthened by increasing the amount of time devoted to the scientific method. Written reports of experiments should be included.
4. Since opportunity for student discussion is presently limited (150 students per lecture section), additional small group (20 students) discussion sections of one hour should be added to the course or one of

the three lectures replaced with discussion sections. The discussion section should include oral and written evaluations of biosocial issues as well as discussions of science and ethics. This would allow use of methods that would aid in achieving a goal of producing scientifically literate student.

5. The lecture should continue to primarily present biological concepts and principles and applied biology, and also introduce issues for discussion sections.
6. Based on a review of textbooks found in this study, the one used in the course should be Invitation to Biology by Curtis and Barnes. The laboratory manuals should be revised to include the above laboratory recommendations. Supplementary readings should be articles chosen for discussion section.
7. Audiovisuals are presently well integrated into the course but an optional evening film series could be considered.

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BIBLIOGRAPHY

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APPENDIX

Appendix A

Study Materials

Saint Mary's College

February 5, 1982

Dear Chairman:

Your department has been randomly selected to participate in a survey of nonmajor biology courses in colleges and universities in the United States and Canada. If a biology course for nonmajors only is offered at your institution, it will be appreciated if you will give the enclosed questionnaire to the faculty member in charge of the course. If you do not offer a biology course for nonmajors only, please complete the questionnaire and return at your earliest convenience. Another part of the survey is analysis of course syllabi. Would you send a copy of the course syllabi for any science course for nonmajors that you offer?

This survey is being conducted under the guidance of Dr. Charles DuVall, professor at Indiana University at South Bend, South Bend, Indiana. The results will aid in the revision of a nonmajor biology course at Saint Mary's College, Notre Dame, Indiana. My position is one of three laboratory teaching assistants for this course which is taught by Dr. James Litton and Dr. Richard Jensen. This teaching team is currently engaged in a year long development project to revise the course.

For your convenience a postage paid envelope addressed to Dr. Charles DuVall is included for return of the questionnaire. Regrettably, return postage for the syllabi is beyond the budget for this survey. However, a return address label has been enclosed to expedite your return.

If you would like a summary of the results of this study, please indicate so on the questionnaire and fill out the enclosed label. The study will be completed by May 1982.

Thank you for your cooperation and immediate reply.

Sincerely,
Janice M. Ivkovich
Janice M. Ivkovich

Approved by:
Charles R DuVall
Charles R. DuVall, Ph.D.
Professor

Biology Department / Saint Mary's College / Notre Dame, Indiana 46556

no. ____________________
(for office use)

QUESTIONNAIRE

DIRECTIONS: Circle the answer which applies or fill in the blank.

1. Does your department presently offer a biology course(s) for nonmajors only? YES NO N/A
   If (YES) go on to question # 3.
   If (NO) go on to question # 2.

2. A. Does your institution offer a combined major and nonmajor biology course? YES NO N/A
   IF (YES) PLEASE SEND SYLLABUS.

   B. Does your institution offer science course(s) for nonscience majors? YES NO N/A
   If (YES) please list course(s): ____________________

   ____

   ____

   ____

   PLEASE SEND SYLLABI.

   C. What are the science distribution or core requirements for nonscience majors at your institution?

   ________________ Semester credit hours

   ________________ Quarter credit hours

PLEASE STOP HERE IF YOUR INSTITUTION DOES NOT OFFER A NONMAJOR BIOLOGY COURSE. RETURN QUESTIONNAIRE IN ENCLOSED ENVELOPE.

3. What is (are) the title(s) of the nonmajor biology course(s)?

   ____

   ____

   ____

   ____

   Send a copy of all syllabi pertaining to your courses with this questionnaire.
   If your department offers more than one nonmajor biology course, select the more general one to answer the following questions. (Indicate with a check which course you are using)

4. Which one of the following describes your course?
   A. Hours per semester (quarter): 1 2 3 4 5 6
   B. Semesters: Fall Spring Summer
   C. Quarters: Fall Winter Spring Summer
   D. List any prerequisites: ______________________________

5. Does this course meet a science distribution or core requirement for nonscience majors? YES NO N/A
   Is there a laboratory requirement? YES NO N/A

6. Which one of the following describes the different components of the course?
   A. Lecture: YES NO N/A
      Times per week: 0 1 2 3 4 5
   B. Laboratory: YES NO N/A
      Hours per week: 0 1 2 3 4 5
   C. Discussion sections: YES NO N/A
      Hours per week: 0 1 2 3 4 5
      In place of lab? YES NO N/A
      In place of lecture? YES NO N/A
   D. Audio - tutorial: YES NO N/A
      In place of lab? YES NO N/A
      In place of lecture? YES NO N/A
   E. Other - please describe: ______________________________
   ____
   ____
   ____

7. Average (estimated) enrollment in course: ______________
   A. Average enrollment in each lab section: ______________
   B. Average enrollment in each discussion section: __________

8. Please state the major goals of your course if not included in the syllabus: ______________________________
   ____
   ____
   ____
   ____

9. What is the author, title, and publisher of the following course materials if not included in syllabus?
   A. Textbook: ______________________________
   B. Lab manual: ______________________________
   C. Supplementary readings: ______________________________
   ____
   ____

10. Do you have special provisions for:
   A. Honor students? YES NO N/A
   B. Handicapped students? YES NO N/A
   If (YES) describe briefly: ______________________________
   ____
   ____
   ____

11. How frequently do you use audio-visual equipment in your course?
   A. Used at all times
   B. Used very frequently
   C. Moderately used
   D. Occasionally used
   E. Not used at all

12. What types of audiovisual equipment do you use most frequently?
   ____
   ____

13. Rank the following areas in order of the emphasis you place on each in your course. A one (1) ranking is for most emphasis and a five (5) is for least emphasis.

AREA	RANK	NOT INCLUDED
A. Biological concepts and principles	____	____
B. Applied Biology	____	____
C. Problem solving skills (scientific method)	____	____
D. Biosocial issues	____	____
E. Personal evaluation of biosocial issues	____	____

14. Do you plan a major revision of your course before 1983?

YES NO N/A

15. Would you like a summary of the results of this study?

YES NO N/A

If (YES) fill out the address label and enclose with questionnaire.

16. Additional comments:

Please enclose this questionnaire in the postage paid envelope to:

Charles R. DuVall, Professor
Division of Education
Indiana University at South Bend
1700 Mishawka Avenue
P.O. Box 7111
South Bend, Indiana

Send syllabi using enclosed address label to:

Janice M. Ivkovich
Biology Department
Saint Mary's College
Notre Dame, Indiana 46556

March 9, 1982

Dear Chairman:

On February 10 a questionnaire for a survey of nonmajor biology courses was sent to you. Your reply is essential to the success of the survey whether or not you offer nonmajor biology courses. Please consider an immediate return of the questionnaire and course syllabus.

Thankyou for your cooperation.

Sincerely,

Janice M. Ivkovich

SYLLABUS CONTENT FORM

ID NUMBER ________
COURSE TITLE ____
WITH QUESTIONNAIRE? YES NO

COURSE MECHANICS

1. Attendance required in:
   - A. Lecture yes no N/G N/A
   - B. Lab yes no N/G N/A
   - C. Discussion yes no N/G N/A
   - D. Field trips yes no N/G N/A
   - E. Other yes no N/G N/A
     List:

2. Methods to control attendance: List:

3. Methods to control makeups of tests, quizzes, lab. List:

4. Textbook (s) required:

5. Lab manual required:

6. Supplementary reading(s) required:

7. Other requirements:

EVALUATION

I. Lectures: Information given Information not given N/A
8. Number of tests (hourlys, prelims) _____________
9. Number of quizzes _____________
10. Term paper(s) required? yes no Number ___________
11. Other reports? List: Number___________

12. Other evaluation? List:

13. Final Yes No Comprehensive Yes No
14. Quizzes announced? Yes No Sometimes
15. Guest speakers? Yes No

16. Film titles: List Yes No N/G N/A
Indicate in lab, lecture, discussion, or other

17. Topics covered by course. Indicate approx. number of weeks. Lecture
- A. Science, scientific method __________
- B. Cell biology (chemistry, structure, function) ______________
- C. Reproduction (asexual, sexual, mitosis, meiosis, animal, plant) _____
- D. Development (animal, plant) __________
- E. Survey of kingdoms, taxonomy ___________
- F. Viruses, bacteria, disease, immunology ______________
- G. Animal anatomy and physiology ______________
- H. Plant anatomy and physiology ________________
- I Mendelian genetics _____________
- J. Molecular genetics ______________
- K. Human genetics _________________
- L. Population genetics ______________
- M. Ecology ____________________
- N. Humans and ecosystems ________________
- O. Evolution and origin of life _______________
- P. Creationism ________________
- Q. Adaptation, behavior, sociobiology ___________
- R. Other: List: _____________
- S. Human biology (anatomy, physiology, reproduction, development) ______

18. Applied biology topics ____________

19. Issues indicated:

20. Lab present? Yes No Information given? Yes No

II. Laboratory

21. Number of quizzes _____________ Announced? Yes No Sometimes

22. Lab reports? Yes No For all labs? Yes No

23. Lab practicals? Yes No Number: _________

24. Lab final? Yes No

25. Other lab evaluation listed? Yes No List:

3.

26. Discussion section present? Yes No Information Given? Yes No
27. Participation evaluated? Yes No
28. Reports? Yes No Number ____________
29. Quizzes? Yes No Number ____________
30. Other information about discussion sectins:

31. Audiotutorial present? Yes No Information Given? Yes No
32. Tests given? Yes No Number __________
33. Final given? Yes No Comprehensive? __________
34. Other? List:

35. Grading Scale:

36. Computers used to achieve computer literacy? Yes No
37. Time spent on computers in weeks _______________
3II. Lab topics - Number of labs per topic
38. Use of microscope _____________
39. Cell biology (structure, function chemistry, photosynthesis, respiration)
____
40. Mitosis and meiosis _______________
41. Fetal pig dissection - anatomy ________________
42. Other animal dissection - anatomy _____________ List:

43. Plant anatomy _____________
44. Animal physiology _________________
45. Plant physiology _________________
46. Human anatomy ____________________
47. Human physiology ____________________
48. Reproduction ______________
49. Human reproduction _________________
50. Development _________________
51. Human development _____________________
52. Genetics (Mendelian, population, molecular) _______________
53. Human genetics _________________

4.

54. Adaptation __________
55. Ecology _________
56. Evolution ____________
57. Survey of organisms, diversity, taxonomy ____________
58. Behavior ________________
59. Field trips __________________ Where:

60. Other types of labs _____________ List:

61. Other information from syllabus.

Appendix B

Description of Respondents

Appendix B

TABLE 29. INSTITUTIONAL CONTROL OF RESPONDENTS*

Type of control	f	%
State, province, or local	50	37
Independent private	33	25
Independent religious (except Roman Catholic)	32	24
Independent Roman Catholic@	19	14
Total	134	100

* Control type data from Peterson's Annual Guide to Undergraduate Study 1982.

@ This symbol, whenever used in Appendix refers to category that fits Saint Mary's College.

Appendix B

TABLE 30. COMPARISON OF INSTITUTIONAL CONTROL OF RESPONDENTS WITH NUMBER IN SAMPLE*

Type of control	Number in sample f	Number of respondents f	%
State, province, or local	109	50	46
Independent: private	73	33	45
Independent: religious (except Roman Catholic)	78	32	41
Independent: Roman Catholic@	39	19	49
Total	300	134	x

* Control type data from _Peterson's Annual Guide to Undergraduate Study 1982_.

Appendix B

TABLE 31. ANALYSIS OF UNDERGRADUATE ENROLLMENT OF RESPONDENTS*

Enrollment	f	%
1- 500	2	1
501- 1,000	29	22
1,001- 1,500	24	18
1,501- 2,000@	11	8
2,001- 4,000	20	15
4,001- 6,000	20	15
6,001- 8,000	8	6
8,001-10,000	5	4
10,001-12,000	4	3
12,001-14,000	2	1
14,001-16,000	3	2
16,001-18,000	2	2
Over 18,000	4	3
Total	134	100

* Fall 1980 enrollment figures from Peterson's Annual Guide to Undergraduate Study 1982.

Appendix B

TABLE 32. ANALYSIS OF STUDENT BODY COMPOSITION OF RESPONDENTS

Student body	f	%
Coed	128	96
Female or primarily female+@	6	4
Male or primarily male+	---	---
Total	134	100

*Student body composition information for each respondent from Peterson's Annual Guide to Undergraduate Study 1982.

+ Primarily male or female means greater than 80% of student body.

TABLE 33. ANALYSIS OF TYPE OF DEGREES AWARDED BY RESPONDENTS*

Degrees awarded	f	%
Bachelors highest@	48	36
Masters or above	86	64
Total	134	100

* Degrees awarded information for each respondent from Peterson's Annual Guide to Undergraduate Study 1982.

Appendix B

TABLE 34. ANALYSIS OF CORE REQUIREMENTS OF RESPONDENTS*

Core requirements	f	%
Yes@	127	95
No	6	4
No data	1	1
Total	134	100

* Core requirement information for each respondent from _Peterson's Annual Guide to Undergraduate Study 1982_.

Appendix C

Institutional Control and Availability of Nonmajor Biology Courses

Appendix C

TABLE 35. COMPARISON OF INSTITUTIONAL CONTROL AND AVAILABILITY OF NONMAJOR BIOLOGY COURSES

Type of institution control	Offer nonmajor biology course(s) f	Offer nonmajor biology course(s) %	Do not offer nonmajor biology courses f	Do not offer nonmajor biology courses %	Total f	Total %
State, province, local	37	74	13	26	50	100
Independent: private	27	82	6	18	33	100
Independent:religious (except Roman Catholic)	21	66	11	34	32	100
Independent Roman Catholic@	15	79	4	21	19	100
Total	100		34		134	

Appendix D

Titles of Nonmajor Biology Courses

Appendix D

TABLE 36. ANALYSIS OF TITLES OF NONMAJOR BIOLOGY COURSES BY GENERAL AREA

	General area*	Number of courses f	%
I	General-eg. Biology, General Biology	57	31
II	Human Biology, Anatomy and Physiology+	36	19
III	Environmental Biology+ and Man	12	7
IV	Ecology	6	3
V	Botany	13	7
VI	Genetics	12	6
VII	Health-Nutrition, Disease, Aging	13	7
VIII	Biology Issues	10	5
IX	Human Sexuality	4	2
X	Evolution	3	2
XI	Marine Biology	3	2
XII	Other	17	9
	Total	186	100

* Specified titles are listed in Appendix D p. 93.

+ Mixed general and topics courses.

Appendix D

Titles Used in Listed Nonmajor Biology Courses

	Area	Course titles
I	General	Biology; General Biology; General Biological Science; Biological Principles; Principles of Biology; Biology Principles; Introduction to Biology; Introduction to Biological Science(s); Fundamentals of Biology; Concepts of Biology; Biological Concepts; Concepts in Biology; Major Concepts in Biology; Biological World; Life Science; Elements of Life Science; Science of Life: A Survey of Life Science; Introductory Biology for Nonscience Majors; Elementary Biology; Contemporary Perspectives in Biology; Contemporary Biology; Topics in Contemporary Biology; Biology for Elementary Education Majors; Biology for General Education, Introductory Biology.
II	Human Biology, Human Anatomy and Physiology	Human Biology; Human Life Science; Biology of People; Biology and Man; Humanistic Biology; Human Aspects of Biology; Topics in Human Biology; Biology: A Human Approach; Biology of Man; The Dynamics of Man; Human Anatomy; Human Anatomy and Physiology; Anatomy and Physiology; Exercise Physiology and Elements of Human Anatomy; Human Biology: Structure and Function; Human Reproduction and Development; Biology of Human Concern; Biology and Human Concerns; Biology and Human Affairs; Living You.
III	Environmental Biology and Man	Man in the Living World; Environment and Man; Man and The Living World; Biology, Environment and Man; Man and His Environment; Environmental Dynamics and Man; Environmental Science: Human Ecology; Human Biology: Man and His Environment: Man in the Biosphere; Man in the Biological World.

Appendix D

Titles Used in Listed Nonmajor Biology Courses (Continued)

	Area	Course titles
IV	Ecology	Environmental Biology; Topics in Environmental Biology; Ecology.
V	Botany	Plant Biology; Plants and Man; Plants and Human Affairs; Humanistic Botany; Botany; The Green World: An Introduction to the World of Plants; Horticulture; World Agriculture; Economic Botany.
VI	Genetics	Genetic Future of Mankind; A Conversational Biology: Human Genetics; Topics in Human Genetics; Human Heredity and Development; Human Heredity; Human Genetics; Genetics and Human Affairs; Human Genetics and Society; Biological Basis of Man's Inheritance.
VII	Health-Nutrition, Disease, Aging	Principles of Nutrition; Introduction to Nutrition; Biological Aspects of Nutrition; Fundamentals of Nutrition; Nutrition; Personal and Community Health and Disease; The Biology of Human Disease; Biology of Aging; Biology and Aging; Topics in Cancer; The Physiology of Health and Fitness.
VIII	Biology-Issues	Issues in Biology; Biology and Society; Biology in Society; Man, Environment and Society; Man, Nature and Society; Selected Topics in the Life Sciences; Personal and Social Responsibility in Human Physiology; Social Biology; Implications of Biology; Science, Technology and Human Affairs.
IX	Human Sexuality	Human Sexuality; The Facts of Life; Sex and Sexuality; Menses to Menopause; Biology of Women.
X	Evolution	Evolution, Topics in Evolution.

Appendix D

Titles Used in Listed Nonmajor Biology Courses (Continued)

	Area	Course titles
XI	Marine Biology	Marine Biology; Introduction to Marine Biology.
XII	Other	Molecular Biology; Cell Physiology; Research Case Studies; Field Study in Natural History; Field Natural History; History of Biology; Ecology, Evolution and Man; Ecology and Evolution; Behavior and Evolution; Scope and Methods of Biology; Biological Control Systems; Atlantic Fisheries; Frontiers of Biology; Animal Behavior; Great Experiments in Biology (in development).

Appendix D

Titles of Nonmajor Biology Courses for Questionnaires and Syllabi

	Title for questionnaire	Syllabus(i) sent
1.	Humanistic Biology	X
2.	Man in the Living World	
3.	The Dynamics of Man	X
4.	Anatomy and Physiology	
5.	Human Anatomy	
6.	Exercise Physiology and Elements of Human Anatomy	X
7.	Biological World	X
8.	Principles of Biology	X
9.	Molecular Biology	X
10.	The Biology of People	
11.	Fundamentals of Biology	X
12.	Biological Principles 103-104	X*
13.	Principles of Biology 111-112	
14.	Life Science	
15.	Biology	
16.	Biology and Society	X
17.	General Biology	
18.	Human Life Science	
19.	Biology and Man	
20.	General Biology	X
21.	General Biology	
22.	Introduction to Biological Science	X
23.	Selected Topics in the Life Sciences	X
24.	Biology 101-102	X*
25.	Human Biology	X
26.	General Biology	
27.	Introduction to Biology	X
28.	Human Biology: Structure and Function	X
29.	Principles of Biology	X
30.	General Biology	X
31.	General Biology	X
32.	Introductory Biology for Nonscience Majors	X
33.	Human Biology	
34.	Biological Science	X

Appendix D

Nonmajor Biology Courses (Continued)

	Title for questionnaires	Syllabus(i) sent
35.	Humanistic Botany	X
36.	Elementary Biology	X
37.	Human Reproduction and Development	X
38.	Biology	
39.	Elements of Life Science	
40.	Human Aspects of Biology	X
41.	Biology of Human Concern	X
42.	Fundamentals of Biology 101-102	X*
43.	Man and the Living World	
44.	Man and His Environment	X
45.	Introduction Biology 1400 The Green World 1401	X*
46.	Principles of Biology	
47.	Biology and Man	
48.	Introductory Biology 1001-1002	X
49.	Topics in Human Biology	
50.	Living You	X
51.	Biology	X
52.	Introduction to Life and Health Sciences	X
53.	General Biology	
54.	Human Heredity and Development	X
55.	Biological Science	X
56.	Contemporary Perspectives in Biology	X
57.	Life Science	
58.	General Biology 101-102-103	X+
59.	Human Biology	
60.	Contemporary Biology	
61.	Scope and Methods of Biology	
62.	Introduction to Biological Sciences 207-208	X*
63.	No name given	
64.	The Facts of Life	X
65.	Science of Life	
66.	Biology in Society	

Appendix D

Nonmajor Biology Courses (Continued)

	Title for questionnaires	Syllabus(i) sent
67.	Human Anatomy and Physiology	X
68.	Biological Basis of Man's Inheritance	X
69.	Introduction to Biology	
70.	Biology, Environment and Man	
71.	Contemporary Biology	X
72.	Topics in Human Biology	X
73.	Human Biology	
74.	Biology: Evolution	X
75.	Biology of Man	
76.	Concepts in Biology	X
77.	Survey of Life Science	X
78.	Frontiers of Biology	
79.	Man, Environment and Society	X
80.	Topics in Contemporary Biology	X
81.	Biology 11 A & B-Introduction to the Science of Living Organisms	X*
82.	Biology for General Education	
83.	Fundamentals of Biology	X
84.	Human Biology	X
85.	Introduction to Biology	
86.	General Biology	X
87.	Principles of Biology	X
88.	Major Concepts of Biology	X
89.	Survey of Biology	
90.	General Biological Science- two semester sequence	X*
91.	Concepts of Biology, Implications of Biology-two semester sequence	
92.	Man in the Biosphere	X
93.	Biology	X
94.	Introduction to Biology	X
95.	Biological World-151 and Biological Concepts-150	X*
96.	Human Biology	X
97.	Natural Resource Conservation	

Appendix D

Nonmajor Biology Courses (Continued)

	Title for questionnaires	Syllabus(i) sent
98.	Man in the Biological World	X
99.	Human Biology	
100.	Science, Technology, and Human Affairs	X
	Total 100	62

* 8-2 semester/quarter, syllabi sent for both

+ 1-3 semesters, syllabi sent for all three

Appendix E

Prerequisites

Appendix E

Prerequisites Listed for Nonmajor Biology Courses

1. Junior or senior status (for Exercise Physiology and Elements of Human Anatomy)
2. High school diploma (for Molecular Biology)
3. Basic math skills (for Selected Topics in the Life Sciences)
4. Ecological Biology (for Human Biology)
5. Admission to college (for Topics in Human Biology)
6. Math and physical science are recommended (for Biological Science)
7. High school biology and chemistry recommended (for General Biology)

Appendix F

Institutional Control and Course Format

Appendix F

TABLE 37. COMPARISON OF INSTITUTIONAL CONTROL AND COURSE FORMAT OF NONMAJOR BIOLOGY COURSES

Type of control of institutions	Lecture				Lab				Discussion				Audiotutorial			
	Yes		No,N/A,N/R		Yes		No,N/A,N/R		Yes		No,N/A,N/R		Yes		No,N/A N/R	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
State, province, local	34	92	3	6	24	65	13	35	8	22	29	78	5	14	32	86
Independent private	26	96	1	4	7	26	20	74	5	19	22	81	2	7	25	93
Independent religious (except Roman Catholic)	21	100	--	--	16	76	5	24	4	19	17	81	3	14	18	86
Independent Roman Catholic	15	100	--	--	8	53	7	47	--	--	--	--	--	--	--	--
Total	96				55				17				10			

N/A - Not applicable
N/R - No response

Appendix G

Other Goals

Appendix G

Other Goals Listed for Nonmajor Biology Courses

1. Emphasis on human pathology.

2. Anatomy of human for exercise-dance majors.

3. Study basic principles of classical and modern genetics; reproductive mechanisms of plants and animals, especially man.

4. To survey the plant and animal kingdoms, their evolution and the development of organ systems as manifested in man.

5. Practice in applied human biology.

6. Bring modification of behavior and attitude in the student with regard to biology.

7. Learn the facts, wonder and diversity of creation, how it works and functions as integrated whole.

8. To instill an interest in, and enthusiasm for, plant science via its history and major applications.

9. Biological basis for fetal development. Learn to communicate orally with others.

10. Special attention is paid to the individual student and his personal survival into the 21st century.

11. Survey of plant and animal systems from a functional viewpoint.

12. Exposure to biology, survey of kingdoms.

13. To overcome student fears that science is an unreachable subject area for them.

14. Have students better understand the biology of abnormal function-i.e. disease.

15. More in depth approach to biology in two semesters than is currently available in natural science program.

Appendix G

Other Goals (Continued)

16. To enable non-biology majors to study the process of change as shown in the history of life. To stress the development of the human race, its physical and mental history. To explore the bases of change operative in the world today. To discover the various possibilities available through science for the control of the evolving process, the future of organisms and the biosphere.

17. How a biologist views life.

18. Course is low on jargon. Teach a scientific attitude.

19. A general overview of biology emphasizing human concerns.

20. Study of man's resources and best use of them.

21. Non chemical approach.

Appendix H

Nonmajor Biology Textbooks

Appendix H

Frequency of Use of Biology Textbooks in Nonmajor Biology Courses

Textbook	Number of courses f
1. Curtis, Helena and Barnes, N. Sue, Invitation to Biology, Worth Publishers, Inc., 2nd or 3rd edition.	7
2. Wallace, Robert A., Biology: The World of Life, Goodyear, 1978.	6
3. Camp, Pamela S. and Arms, Karen, Exploring Biology, Saunders College Publishing: Philadelphia, 1981.	5
4. Volpe, E.P. and deGray, C.V., Man, Nature and Society, Wm. C. Brown Co., 1979.	5
5. Keeton, William T., Elements of Biological Science, W.W. Norton and Co., New York, 1973	4
6. Mader, Sylvia S., Inquiry into Life, Wm. C. Brown, Dubuque, Iowa, 1979.	4
7. Rahn, Joan E., Biology, The Science of Life, Macmillian Publishing Co., Inc., New York, 1980.	4
8. Singer, Sam and Hilgard, Henry R., The Biology of People, W.H. Freeman & Co., San Francisco 1978.	4
9. Starr, Cecie and Taggart, Ralph, Biology: The Unity and Diversity of Life, Wadsworth Publishing Co., Belmont, California, 1981	4
10. Clark, Mary E., Contemporary Biology, W.B. Saunders Co., Philadelphia, 1979.	3
11. Sherman, Irwin W. and Sherman, Vilia G., Biology: A Human Approach, Oxford University Press, New York, 1979.	3

Appendix H

Biology Textbooks (Continued)

Textbook	Number of courses f
12. Ward, Jack A. and Hetzel, Howard R., Biology: Today and Tomorrow, West Publishing Co., St. Paul, 1980.	3
13. Applewhite, Philip and Wilson, Sam, Understanding Biology, Holt, Rinehart, and Winston, New York, 1975 and 1978.	2
14. Goldsby, Richard A., Basic Biology, Harper and Row, New Yori, 1979.	2
15. Moran, Joseph M., Morgan, Michael D., and Wiersma, James H., Introduction to Environmental Science, W.H. Freeman and Co., 1980.	2
16. Wagner, Richard, Environment and Man, Norton, 3rd edition.	2
17. Ballentine, Robert and Ballentine, Dorothy, Man and the Living World, The McCollum-Pratt Institute, The Johns Hopkins University Press, not yet in print.	1
18. Boughey, Arthur S., Man and the Environment, Macmillian, 2nd edition.	1
19. Burkart, John and Ciarenza, Loretta, Topics in Human Biology, Avery Publishing Co., Wayne, New Jersey, 1978.	1
20. Davis, P. William and Soloman, Eldra Pearl, The World of Biology, McGraw-Hill Book Co., New York, 1979.	1
21. Deamer, David, Being Human, Saunders, 1981.	1
22. Dienhart, Charlotte M., Basic Human Anatomy and Physiology, Saunders, 3rd edition.	1
23. Enger, Eldon D. and others, Concepts in Biology, Wm. C. Brown Co., Dubuque, Iowa, 1979.	1

Appendix H

Biology Textbooks (Continued)

Textbook	Number of courses f
24. Focus: Biology, Annual Editions Reader, 3rd edition Duskin Publishing Group, Sluice Dock, Guilford, CT., 1978.	1
25. Gehring and Brett, Conversational Biology: Human Interest by Professors of course.	1
26. Goin, Coleman J. and Goin Olive B., eds., Man and the Natural World: An Introduction to Life Science, Macmillan, 2nd edition.	1
27. Hendrickson, Herbert T., Essential Biology Harper and Row, 1981.	1
28. Human Body - Facts on File, by Professor.	1
29. Jensen, William A. and others, Biology, Wadsworth Publishing Co., Belmont, CA., 1979.	1
30. Jones, K.L., Byer, C.O., and Shaenberg, L.W., Principles of Health Science, Harper - Row, 1980.	1
31. Jones, K.L., Byer, C.O., and Shaenberg, L.W., The Human Body, not found in Books in Print.	1
32. Journals and articles in place of text.	1
33. Kimball, John W., Man and Nature: Principles of Human and Environmental Biology, Addison-Wesley, 1975.	1
34. Leopold, Aldo, Sand County Almanac, Oxford University Press, 1949.	1
35. Levy, Charles Kingsley, Biology: Human Perspectives, Goodyear Publishing Co., 1979.	1
36. Life and Health, Communications Research Machines, Random House, 1980.	1

Appendix H

Biology Textbooks (Continued)

Textbook	Number of courses f
37. Luria, Salvador E., Gould, Stephen Jay, Singer, Sam, A View of Life, The Benjamin/Cummings Publishing Co., Inc., Menlo Park, CA, 1981.	1
38. Mange, Arthur P. and Mange, Elaine J., Genetics: Human Aspects, Holt Rinehart and Winston.	1
39. McClintic, J. Robert, Physiology of the Human Body, Wiley, 1978.	1
40. McNally, Robert, Biology: An Uncommon Introduction, Canfield Press, San Francisco, 1974.	1
41. Memmler, Ruth L. and Wood, Dena L., Structure and Function of the Human Body, Harper-Row, 1977.	1
42. Nagle, James J., Heredity and Human Affairs C.L. Mosby Co., St. Louis, 1979.	1
43. Novitski, Edward, Human Genetics, Macmillan, 1977.	1
44. Owen, Oliver S., Natural Resource Conservation, Macmillan, 1980.	1
45. Parker, Ecology, The Fossil Record.	1
46. Purdom, P. Walter and Anderson, Stanley, H., Ecosystems and Human Affairs, not found in Books in Print.	1
47. Ritchie, Donald and Carola, Robert, Biology, Addison-Wesley, 1979.	1
48. Schefler, William C., Biology: Principles and Issues, Addison-Wesley, Reading, Mass., 1976.	1
49. Silverstein, Alvin, Human Anatomy and Physiology, Wiley, 1980.	1

Appendix H

Biology Textbooks (Continued)

Textbook	Number of courses f
50. Soloman, Eldra P. and Davis, P. William, Understanding Human Anatomy and Physiology, McGraw-Hill, 1978.	1
51. Swanson, Harold, Human Reproduction Biology and Social Change, Oxford University Press, 1974.	1
52. Tippo, Oswald and Stein, Wm. L., Humanistic Botany, W.W. Norton and Co., New York, 1977.	1
53. Tortora, Gerald J. and Becker, Joseph F., Life Science, Macmillan, New York, 1978.	1
54. Volpe, E. Peter, Understanding Evolution, Wm. C. Brown, Dubuque, Iowa, 1982.	1
55. Witters, W.L., and Witters, P.Jones, Envrionmental Biology: The Human Factor, Kendall/Hunt, 1978.	1
56. Klein, Richard M., The Green World, Harper and Row, New York, 1979.	1
Total*	100

* 8 respondents had 2 required textbooks
1 respondent had 4 paperbacks
1 respondent had articles
11 respondents did not require textbooks or gave no response

Appendix I

Supplementary Readings

Appendix I

Supplementary Readings Required in Nonmajor Biology Courses

I. Books - 11 institutions

A. Anatomy, Murray and Conte
B. Sand County Alamac, Leopold, Aldo
C. Life Science, Nesius
D. Guide to Family First Aid
Red Cross First Aid Module
E. Race and Races, Goldsby 2nd ed.
F. Readings in Human Biology, Burkart and Chiarenza, Avery Publishing Co.
G. General Zoology Textbooks
H. Environment and Man, Jackson
I. Lovins, Schumacher, Borgstrom, Leopold
J. Never Cry Wolf, Mowat

II. Scientific American Reprints (Offprints)-4 institutions

III. Study guides-6 institutions (4 optional)

IV. General Media articles and scientific articles on reserve-13 institutions, 3 listed articles

A. "New Ethics for Survival", Harding Supernutrition, Passwater, (selections from) "Psycodietics" Cherskin and Ringsdorfi, "Muddling Toward Frugality", Johnson, and others not listed.
B. "How Ape Became Man"
"Genetic Gibberish in the Code of Life"
"Creationism Articles"
"Tinkering with Life"
"Do Diets Really Work"
"How Human Life Begins"
"Melancholy Genes"
"Brain Opiates in Mental Illness"
"Medfly Continues to Bug California"
"Lifeboat Ethics"
C. The Living Cell, J. Bracket
"Power House of the Cell", P. Sichevitz
"Microcirculation of the Blood", R.W. Zeifach
"The Heart's Pace Maker", E.F. Adolf
"The Mechanism of Breathing", W.O. Fenn
"Decorator Crab" Wicksten
Parts of Antony Van Leeuwenhoek
"The Iland and Oryx", C.R. Taylor and others

Appendix J

Laboratory Manuals

Appendix J

TABLE 38. LABORATORY MANUALS REQUIRED IN NONMAJOR BIOLOGY COURSES

Titles	f	%
Freeman Laboratory Outlines in Biology, W.H. Freeman Co.	3	3
Kaplan, Experiences in Life Sciences, Macmillan, 2nd ed. 1976.	2	2
Keeton, Dobnez, Zollenhoffer, Biology in the Laboratory, Norton Publishing Co., New York.	2	2
Mader, Sylvia S., Laboratory Manual for Inquiring into Life, Wm. C. Brown: Dubuque, Iowa, 2nd ed.	2	2
Other-each mentioned by only one institution*	13	13
Manuals written by professor or institution	19	19
No manual or no lab	59	59
Total	100	100

* Other manuals listed in Appendix J on page 117.

Appendix J

Other Laboratory Manuals for Nonmajor Biology Courses

Title

1. Eberhard, Arms, Camp, Biology Laboratory Manual.
2. Volpe, E.P., and deGray, C.V., Man Nature and Society Lab Manual, Wm. C. Brown Co.
3. Schift and Burgess, 21 Afternoons of Biology.
4. Kurtz and Basanlas, Biology-An Individualized Approach.
5. Biggers, Beck, and Brown, Biology Laboratory Experiences, Burgess Publishing Co., 1st ed.
6. Aspey, W.P., Humanistic Biology, Burgess, 1980.
7. Nesius, Life Science.
8. King, Exercises in General Biology, 1981.
9. Mehall, Laboratory Manual for Anatomy and Physiology.
10. Gardner and Mertens, Genetics Laboratory Investigations.
11. Reid, Allen F., Biology of Man Laboratory Guide.
12. Leonard, Laboratory Investigations in Biology, Burgess.
13. Johnson, Pat, General Biology in the Laboratory, Hunter Publishing Co.

Appendix K

Audiovisual Materials

Appendix K

Other Types of Audiovisual Materials Used in Nonmajor Biology Courses

1. Multi and single image lectures.
2. Computer programmed instruction.
3. Programmed books.
4. Film strips and audio tapes.
5. Photomicrographs-own slides.

Appendix L

Enrollment and Audiovisual Materials in Nonmajor Biology Courses

Appendix L

TABLE 39. COMPARISON OF ENROLLMENT IN NONMAJOR BIOLOGY COURSES WITH FREQUENCY OF USE OF AUDIOVISUAL MATERIALS

Enrollment nonmajors biology	Audiovisuals											
	Used at all times		Used very frequently		Used moderately		Used occasionally		Not used at all		Total	
	f	%	f	%	f	%	f	%	f	%	f	%
0- 50	4	11	9	26	9	26	12	34	1	3	35	100
51-100	3	14	6	27	8	36	4	18	1	5	22	100
101-150	2	15	5	39	3	23	3	23	--	--	13	100
151-200	--	--	1	17	3	50	2	33	--	--	6	100
201-250	--	--	1	20	2	40	2	40	--	--	5	100
251-300	3	75	1	25	--	--	--	--	--	--	4	100
301-600	--	--	3	33	3	34	2	22	1	11	9	100
601-800	--	--	--	--	--	--	--	--	--	--	--	--
Over 800	3	50	2	33	1	17	--	--	--	--	6	100
Totals	15		28		29		25		3		100	

Appendix M

Exceptional Students

Appendix M

Comments on Provisions for Exceptional Students

I. Handicapped students:

- A. Blind students have taken the course.
- B. Any needs are individually dealt with.
- C. Access to buildings and facilities.
- D. As needed-two blind students the past two years. Extra work with models and clay.
- E. We have tapes, scripts, etc.
- F. Special lab desks and equipment.
- G. We make a special effort to assist them complete (sic) all assignments. Tutors and conferences with faculty.
- H. Have had blind students but we just do the best we can. Not qualified-so we use tutors and hope we have helped.
- I. Special assistance through lab assistants, tapes, videotapes of lectures.
- J. Only has applied to overnight field trip and student is given a special project.
- K. Tapes, separate testing as needed, tutors.
- L. Individual student case treated separately.
- M. Handicapped students have access to the building and can attend; blind students can get the test recorded through an outside agency.
- N. For visually impaired-braille texts, tape recorders, readers; for hearing impaired-people to sign in class.
- O. Modified labs, individualized help, plus office of physically impaired give assistance-our staff usually does double duty to help.
- P. Each case individually.
- Q. Individual attention; readers; recorders; Braille texts.
- R. For first time this year student legally blind taking course.
- S. Access ramps; tutors for deaf.
- T. Blind students are given special help with exams from the learning assistance laboratory on campus. Special lab exams are made up to accommodate these students.
- U. As defined for each student by instructor and campus advising group.

Appendix M

Comments (Continued)

II. Honor students:

- A. If our majors take the courses (can't get information in another course) they take it as independent study and do research in the area as well. (Referring to topics courses)
- B. Recommended additional reading.
- C. They are encouraged to take a major sequence to fulfill the requirement.
- D. Earned exemptions from final unit exam. Exemptions from cut requirements.
- E. We offer Bio 301, Revolutions in Biological Thought, to honor students.
- F. If honor students-more challenging courses.
- G. Weekly discussion session.
- H. Don't understand this question as it relates to this specific course!

Appendix N

Lecture Topics

Appendix N

Other Lecture Topics, Areas of Applied Biology and Biology Issues from Syllabi

I. Other lecture topics:

- A. Cancer
- B. Aging
- C. Human nutrition and diets
- D. Stress: relationship to disease and fatigue
- E. Scientific terminology
- F. Tissues
- G. Continental drift
- H. Organ transplants
- I. Drugs and effects
- J. History of science.

II. Applied biology areas:*

- A. Contraception
- B. Cancer, diseases and aging in humans
- C. Exercise physiology-physical fitness
- D. Human nutrition and dieting (eg. physiology of starvation)
- E. Drugs, smoking, alcohol-effects and abuse, also effects on unborn
- F. Allergies
- G. Genetic engineering (Recombinant DNA)
- H. Mental health (eg. psychosomatic medicine, meditation, and stress)
- I. Genetic counseling, screening (amniocentesis)
- J. Economic botany (2)
- K. Organ transplants
- L. Veneral disease
- M. Infertility and sterility-pregnancy tests, fertility drugs
- N. Land and water management
- O. Drug and hallucinogen plants

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* Most syllabi did not give a clear indication of applied biology topics and biosocial issues. The above list gives general areas covered by one or many courses. Some of applied biology topics or lecture topics may also have had biosocial issues incorporated with them.

Appendix N

Other Lecture Topics (Continued)

III. Biosocial issues:*

- A. Is parenthood an inherent right?
- B. Population problems-lifeboat ethics
- C. World food problem
- D. People and nature in conflict-pollution issues
- E. Energy crisis
- F. Implications of genetic engineering (recombinant DNA research controversy)
- G. Social issues and implications of organ transplants
- H. Cancer politics
- I. Abortion
- J. Evolution vs. creationism
- K. What is responsible sexual behavior?
- L. In-vitro fertilization, right or wrong? Will we choose sex of our offspring?
- M. Natural childbirth-breast feeding pros-cons
- N. Cloning
- O. Responsible patienthood

Appendix O

Laboratory Topics

Appendix O

Other Laboratory Topics in Nonmajor Biology Courses with Syllabi

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1. Metric system
2. Bioroulette: A model
3. Monera and protista
4. Scientific method
5. Observation and measurement
6. Topics from Kaplan, Fxperiences in Life Sciences:
    a. What is Science? (2 courses)
    b. Inductive and Deductive Reasoning (2 courses)
    c. Deduction (2 courses)
    d. The Model (2 courses)
    e. Pond Ecology-Computer Model*
    f. Construction of an Experiment (2 courses)
    g. Hypotheses (2 courses)
    h. Metabolism
    i. Problem Solving in Genetics
    J. Natural Selection Model*
    k. Organization and Application of Information
    l. Requirement of Accuracy in Science (2 courses)

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* Not in manual-used handouts

Appendix P

Respondents without Nonmajor Biology Courses

Appendix P

Titles of Other Nonmajor Science Courses Offered by Respondents without Nonmajor Biology Courses*

I. Physics:

- A. Physical Science
- B. Physical Concepts
- C. General Physics
- D. Physics (for nonscience majors)
- E. Introductory Physics
- F. Principles of Physical Science
- G. Introduction to the Science of Physics

II. Chemistry:

- A. Principles of Chemistry
- B. Basic Chemistry
- C. Chemistry (non lab)
- D. Introductory Chemistry
- E. Chemistry and People

III. Other:

- A. General Geology
- B. Ornithology
- C. Natural History (for Elementary Education majors)
- D. Traditional Plant Uses I and II
- E. Environmental Science
- F. Biology of Sex
- G. Biology of Substance Abuse
- H. Human Sexuality
- I. Heredity and Society
- J. Environmental Issues (2)
- K. Science for General Education
- L. Science for Elementary Education Majors
- M. Science for Nonscientist
- N. Botany: Plants-The Key to Survival
- O. Basic Horticulture
- P. Human Reproduction
- Q. Local Flora

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* Only 20 institutions listed nonscience courses. Biology courses are for majors and nonmajors. Two mentioned courses for nurses.

Appendix P

TABLE 40. ANALYSIS OF SCIENCE CORE REQUIREMENTS OF RESPONDENTS WITHOUT NONMAJOR BIOLOGY COURSES

Credit hours	Semester f	Semester %	Quarters f	Quarters %	Total f	Total %
00	2*	6	--	--		
03	--	--	1	3		
04	4	11	--	--		
05	--	--	2	6		
06	2	6	--	--		
07	2	6	--	--		
08	9	26	--	--		
09	1	3	--	--		
10	1	3	--	--		
11	--	--	--	--		
12	2	6	3	9		
13	--	--	--	--		
14	1	3	--	--		
Not given	3*	9	1	3		
Total	27	79	7	21	34	100

* One was trimester in each figure.

Appendix Q

Comments on Format

Appendix Q

Comments Concerning Course Format of Nonmajor Biology Courses*

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1. a. We have one quarter courses organized around a theme. Most have a few laboratory sessions included in them.

   b. We are on terms which are 11 weeks long. Each course is worth three semester hours or four and one half quarter hours. Forty courses are required for graduation which equals 120 semester hours. 013 +

2. Optional lab meetings are given three or four times per semester along with two movies. 016

3. The core requirement for nonscience majors is eight hours. I consider this the bare minimum. 019

4. Discussions and audiovisuals are used with lecture. Tutorial services are provided outside of lab and lecture time. (90 in course, 5 sections)

5. We have an optional lab experience. 033

6. Our science core requirements are in the process of change in order to require a lab science. The number of credit hours are not yet decided. (Present-8 semester hours) 052

7. Discussions are provided for during a portion of each lecture. (50 in course) 067

8. I have introduced a one hour lab and/or discussion which meets about every third week. I would like to have it meet every other week. 069

9. There is one film per week. 071

10. There are three or four review sessions per quarter. 073

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* Comments were edited to remove institution names, incorrect wording and extraneous phrases.

+ Refers to institution number.

Appendix Q

Format Comments (Continued)

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11. Students may enroll in a lab section that accompanies this course, if they wish, for one hour of credit. 084

12. During the academic year 1980-1981, our graduation requirements were changed so that it is now necessary for any nonscience graduate to have successfully completed one laboratory course in the physical and life sciences ..... Consequently, I am currently charged with developing a suitable general biology course with a lab to be offered to nonscience majors. (from a letter added to questionnaire) 098

13. The laboratory is primarily self paced. 103

14. Pre-exam review sessions are also offered. Tutoring is by senior lab assistants (biology majors). There are some contractual elements and retesting to pass course. 104

15. During each 50 minute lecture period students view a 30 minute videotape and then have 20 minutes for discussion. (800-850/semester) 106

16. Discussion is used in lecture along with audiovisual material. A Book of Readings is used to correlate with class material. 147

17. Our course is a three semester hour course. In the fall and spring it is scheduled either on M-W-F for three 50 minute lectures, or on Tu-Th for two 75 minute lectures. This course is also taught in an intensive summer schedule of 85 minute lectures five days a week for five weeks. 165

18. We also have a one hour a week film series.

19. a. There is frequent use of films and guest speakers on special topics in lecture sections.

    b. We are currently revising our core requirements . . . and are looking carefully at the science for the nonscientist literature. (Presently 8 semester hours of science) 231

20. The institution will be switching to semesters in fall of 1983 and all courses will be revised then. 238

Appendix Q

Format Comments (Continued)

21. We have a resource center with optional activities. 254

22. Our nonmajor course has a separate lab course for certain students, such as nursing and physical education majors. This is a two hour credit course meeting three hours per week. 282

Appendix R

Other Comments

Appendix R

Other Comments Concerning Nonmajor Biology Courses*

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1. We find that single courses in applied science and biology go much better than a standard course teaching biological principles in general. 013+

2. a. We have no biology course for the nonmajor (have fought it off for years). (From attached letter)

   b. I've always contended there is more reason for a nonmajor course in chemistry or physics than in the biological sciences. Biologists pretend to survey the whole field in one or at most two semesters. But in chemistry if you want to find out anything about organic chemistry you have to take at least three semester courses. In physics you have to take at least three semesters to get any information about nuclear physics. 019

3. For our purposes I think the lab manual is excellent (Kaplan, Experiences in Life Science). Not all students would agree because there can be lots of frustration for those who refuse to think. 021

4. a. In lab we do have a computer simulation of pond ecology. Each student gets hands on experience with a PET microcomputer. (50 in course)

   b. You may notice we include a significant amount of history and philosophy of science. Also, being a Christian college, we try to include a Christian perspective when discussing issues where Biblical teaching differs from other points of view. 030

5. I have sent information only on Biology 100 (the nonmajor course). I am sending a syllabus of Biology 121 as well. It is a more standard course for both majors and nonmajors. It has a lab, less emphasis on contemporary biological and societal problems, and emphasizes lab skills and the use of the scientific method. (Biology 100 had no lab.) 033

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* Comments were edited to remove institution names, incorrect wording, and extraneous phrases.

+ Refers to institution number.

Appendix R

Other Comments (Continued)

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6. For 25 years this course was a two semester sequence. It became a one semester course last fall, so I have essentially just made a major revision. (Now 4 semester hour course with 3 lectures and 4 hours of lab a week.) 052

7. Personal views of students are obvious, but not promulgated. 067

8. Both of our courses are very popular among nonscience majors. In the College of Science and Technology we receive two thirds of all nonmajors who must satisfy their science requirements. (8 hours) (This from an audiotutorial four hour, two semester course with 275 to 300 students enrolled per semester.) 075

9. Each faculty member is responsible for his own syllabus, textbook selections, etc. (Enrollment in course 300-400 with different sections taught by different faculty.) 084

10. I require each student to prepare an oral report relating societal concerns to human reproduction. These are all given at the end of the term in place of lecture. (Topics course-Human Reproduction and Development) 098

11. a. This may not be correct. The laboratory deals almost entirely with processes of science and as such is problem solving from its approach. (This comment was referring to ranking problem solving skills at level five in question 13.)

    b. We expect to convert to semesters in 1984. A major course revision will occur then.

    c. I suggest you consider the processes of science as part of your new look. College faculty take for granted students can demonstrate knowledge of things like distinguishing between two and three dimensional objects, the melting point of water, or distinguishing between mass and volume. I give a pretest (perhaps 5,000+ students), and never have I had a student pass more than four of the basic processes (These are nonscience majors.). I use Kurtz lab book which is now unavailable, but he was in on developing Science-A Process Approach for A.A.A.S. and so those materials are important sources. I have other ideas for non-

Appendix R

Other Comments (Continued)

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science majors that fly against tradition. I teach Cr-no credit only. I administer a 10 minute opportunity when they walk into lecture. Every test (opportunity) has one third old material, thus comprehensive, and they can never let go of the old material. When we get to ecology or nutrition they do very well. 103

12. a. The course involves developing systems models.

    b. I plan a lab revision next to develop better correlation to course objectives and progressive complexity suiting acquisition of greater skills. I will be able to incorporate computer literacy concepts. 104

13. There is no syllabus or textbook. Some sense of the course content may be gained from the Table of Contents of the book I am writing based on the course. 112

14. The course is taught as much as possible from Biblical Christian perspective. 116

15. Our general biology course is also available to nonmajors but this will not fulfill the science core requirement. (The course that satisfies a 3 hour core requirement is Science, Technology and Human Affairs) 133

16. Our nonmajors are grouped:

    1001-1002 Business and art majors
    1631-1632 Physical education majors
    2000-2001 Secondary education majors

    139

17. I have had success with the students in this structured type course. Quizzes at the end of each chapter and four major tests prove to me they are assimilating the material and enjoy doing so. 147

18. All are given special emphasis where most appropriate to do so. (Referring to question 13) 178

19. Intensive testing procedure is used in this course. The course syllabus is essentially the Table of Contents of the textbook. 184

Appendix R

Other Comments (Continued)

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20. This course introduces many students to biology. They then may take Human Genetics or General Biology with majors. 215

21. We purposely do not teach a human-oriented or a survey-of-the phyla introductory biology course. This course focuses on key themes and concepts of biology. 254

22. Until recently the course was audiotutorial. The course has been redesigned toward a more traditional lecture and laboratory format. 257

23. The course as taught recently will be changed next year from classical biology course to a current topics, man and his environment course. (Now 2 lectures, one 3 hour lab/week, 200 students) 274

24. Two other professors also teach this course-one stresses man and medicine, and the other treats alternate life styles, an ecology course. (Course: Man in the Biological World) 297

25. This is a new course, less than two years experience. It is therefore still developing. (Course: Introductory Biology and The Green World) 119

Appendix S

Science Course Survey

UNIVERSITY OF CENTRAL ARKANSAS

Robert D. Wright, Chairman Biology Department

APPENDIX S. SURVEY OF SCIENCE COURSES FOR NONSCIENTIST AT SELECTED UNIVERSITIES

SCHOOL	STUDENT BODY	BIOLOGY FACULTY	GEN. EDUC. BIOL. COURSES	GEN. EDUC. LAB COURSES	GEN. ED. STUDENTS	GEN. ED. NON-LAB STUDENTS	LAB REQ.
W. Michigan		13	4	3	570	350	no
S.W. Texas		29	3	2	1300	900	yes
Bowling Green	16,000		4	2	4700	300	yes
Ball State		24	1	1(AT)	1500	0	yes
W. Illinois	13,000	27	5	4	1000	0	yes
N. Illinois	25,000	34	4	1	700	2100	no
N. Michigan	9,000	15	6	6			yes
Winona State	5,000	10	5	4			yes
Ill. State Bloomington	20,000	37	4	1			yes
Murray State		12	2	2			yes
S. Colorado		10	3	0			no
UCA	6,000	12	5	3	1700	150	yes